DEPARTMENT OF HIGHWAYS

ONTARIO

ONE GEOGRAPHER'S ROLE IN HIGHWAY PLANNING

R. I. WOLFE
PLANNING AND DESIGN BRANCH

ERRATA SHEET

PAGE	LINE	
2	2	for "intergrate" read "integrate"
9	9	for "they were" read "it was"
11	20	insert "dollar" after "quarter-billion"
13	6	delete "s" from "Exhibitions"
16	22	delete "s" from "years"
17	6	delete "a" at beginning of line
17	18	delete "a" from beginning of line
18	2	insert comma after "procedures"

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by

R. I. WOLFE

DEPARTMENT OF HIGHWAYS OF ONTARIO

Prepared for presentation at the Annual Meeting of the Canadian Association of Geographers, June 2 - 4, 1960, Queen's University, Kingston, Ontario.

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ONE GEOGRAPHER'S ROLE IN HIGHWAY PLANNING

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INTRODUCTION

Planning is a field towards which geographers gravitate naturally. Their preoccupation with areal differences on the earth's surface, and with the interplay of the forces that have brought about these differences, gives them a background of knowledge, experience and modes of thought that planning organizations of many kinds have found extremely valuable. Thus, geographers have helped government at all levels to plan entire new communities and rehabilitate old ones, and they have been employed by large corporations to solve such problems in business planning as finding the optimum site for a new head-office building.

It would accordingly seem reasonable to expect geographers to have been involved for a long time in highway planning - for at least as long a time, at any rate, as in urban planning. This, however, does not seem to be the case. One possible reason is that the planning of highways, in the modern sense, is itself so new.

When two highways engineers were recently asked: "When did highway planning begin?", one answered "Thousands of years ago", and the other, "It hasn't begun yet". Each had cogent arguments to back up his case, but both finally agreed that the large-scale, comprehensive procedures that characterize what we now think of as highway planning have had a history that goes back little further than fifteen years, i.e., to the end of World War II.

It is true that the need was recognized much earlier. In 1925, for example, Lewis Mumford was already pointing out the unhappy consequences that might be expected from construction of inadequately

planned highway networks.[1] And at about the same time efforts were begun to intergrate regional and highway development in the Chicago Metropolitan Area.[2] Also, in the 1930's plans were afoot to provide the United States with a comprehensive interstate highway system,[3] plans that are just now coming into fruition. For a depression had to intervene, and a war to be fought, before a widespread, concerted effort at planning highways began. Then, as a result of the years of neglect that highways suffered during depression and war, and because of the demands that were made by the vast increase in highway travel and vehicle ownership whose beginnings were then seen, and that has astonished and dismayed us in the years since, highway problems suddenly became grossly magnified, and a greater sophistication than ever before was required in the search for solutions.

Not only was it imperative to solve existing problems, but, if the future were to be spared even more intractable ones, accurate forecasts of future conditions affecting highways had to be made. Thus the need for adequate planning was at last widely recognized, and the recognition acted upon.

BEGINNINGS IN ONTARIO

In Ontario a formally constituted Planning Division did not come into existence until 1954, a year in which the Department of Highways underwent radical reorganization. With the coming of the Planning Division came the first geographer to be specifically designated as a highway planner (though for some years previously at least two geographers had been on the Department's staff, one as a photogrammetrist helping to lay out the locations of highways, the other - myself - as a statistician designing and analyzing the results of experiments on materials and soils). The first geographer-as-highway-

planner was Mr. Roger Truemner (now Director of the Regional Development Branch of the Manitoba Department of Industry and Commerce), who stayed with the Planning Division for about three years. By the time I joined him, at the end of 1955, he had already established many of the principles that still guide us.

Dearth of Precedents

His was by no means an easy task. To begin with, there were few precedents, either academic or professional. We all know how wide a range of subject matter is embraced by geography in the university; but even so, whatever courses Mr. Truemner had taken in urban or transportation geography could have given him little preparation for precisely the kind of geographic problems he would have to face. Nor could he have turned elsewhere for guidance; there was no conceptual framework, no literature.

To be sure, the literature on highway planning is vast, but little of it is by geographers, and until the recent publication of the book by William Garrison and his associates, "Studies of Highway Development and Geographic Change,"[4] none of it was readily accessible to the student geographer. Only when he became professionally engaged in highway planning would he be likely to learn of the literature's existence, and by then the pressure of day-to-day work would make it extremely difficult for him to do his library research at all adequately.

Scope of Highway Research

Let me give you some idea of the scope of highway research on this continent today - though very little, I am sorry to say, is done in Canada.

Every January there is a week-long meeting of the Highway Research Board at Washington, D.C. At the most recent one there was an

attendance of over 3,000. Aside from numerous committee meetings devoted to specialized aspects of highway research, there were 59 technical sessions, in which 370 participants presented 259 papers and took part in half a dozen symposia. Of these papers at least 45 were directly applicable to our work in highway planning. In the last few years a trend has been evident towards more and more papers by non-engineers on non-engineering highway problems, and it was continued at the most recent meeting.

Several of the papers that were applicable to our work, among them one on "The Influence of Highways upon Selection of Six Industrial Locations", and another on "Highway By-passes, Natural Barriers, and Community Growth in Michigan", were of direct geographic interest.* As far as I have been able to discover, not one was by a geographer. A search through the Proceedings of H.R.B. meetings for 25 years back reveals how pitifully small has been the published contribution of geographers to highway research, for at no single meeting has the situation been much better than at the most recent one.

Literature in the Geography of Transportation

When we see the vast changes that highways are making in our urban and rural landscapes, this under-representation of geographers among the massive ranks of research workers on highway problems is surprising. The surprise turns to shock when the specifically geographic literature is examined. In "American Geography: Inventory and Prospect" Edward L. Ullman points out that research in transportation geography as a whole is surprisingly small.[5] He begins the paragraph he devotes to highways with the statement: "In spite of the availa-

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* Neither of these papers is yet in print, though in time both will be, either in the Proceedings of the 1960 Meeting of the H.R.B. or in special bulletins. The first is by Donald J. Bowersox, Michigan State University; the second, by Louis Vargha, University of Kentucky.

bility of statistics on highway traffic in the United States, geographical studies of highways are few. Yet some 85 percent of the total volume of intercity passenger traffic moves by highway." These sentences, published six years ago, remain substantially true today. Even Ullman himself, in his many books and papers on the geography of transportation, says almost nothing about highways. Turn to the Annals, to Economic Geography, to the Review, to the recently published anthology on urban geography edited by Mayer and Kohn,[7] and the drought continues.

Turn to our own Wreford Watson's schoolbook on general geography, to the chapter devoted to transportation, and you will find seven pages on railways, eight on waterways, three on the air age, and just one page on roads - and most of that is historical.[8] It is simply astonishing that, in a textbook published no longer than three years ago for Canadian high school students - the great majority of whom rarely travel by train, ship, or plane, but almost every day in cars or buses - the emphasis should be so unrealistic.

If a transportation geographer of 500 years hence had no other source of information about the geography of our day than our geographic journals, monographs and textbooks, he would come to an interesting conclusion: he would write that we were a very mobile people, with great cities linked together by railways, waterways, and airways - and in a footnote he would add that oh yes, there seems to have been a minor mode of travel, by something called a motor vehicle, over something called a highway.

And yet, here is a field worthy of the best geographic work we are capable of doing. Here is an opportunity to put to use all the tools of the geographer's trade, almost without exception.

Value of General Geographic Background

For here is the point: Mr. Truemner did not come to his new duties entirely unprepared. After all, he was a geographer, and if no one had cleared the way for him in the geography of transportation he did have the tools taken from the many other aspects of geography in which he had received training, and which would find direct application in his new work. For one thing, he was the photogrammetrist that I mentioned earlier, and competence in the interpretation of aerial photographs is of inestimable value in highway planning. This is a technique we all learn something about as undergraduates. Further, at the heart of the planning process, as at that of geography, is the making and interpreting of maps.

For the rest, let me speak of my own background as a specialist in the geography of recreation in Ontario. When I in my turn became a highway planner this background proved to be of great value in several ways:

1. It involved gaining familiarity through field work with almost all inhabited parts of Ontario, and a good many of its wilderness areas. In itself the experience of conducting field work, common to all geographers, was important.
2. A thorough examination of the economic and social history of the Province revealed the pattern of Ontario's past development, and facilitated the necessary process of predicting future development.
3. In gathering information about past and present, I cultivated many sources of information in various governmental Departments, such as Lands and Forests, Mines, Agriculture, Planning and Development, and so on - a useful preparation for the liaison work essential in highway planning.

4. Since travel is so important a part of the recreational pattern, intimate knowledge of transportation problems in Ontario was necessary; this involved gathering information about:

   a). the history of the various means of transportation - water, rail, road, air;

   b). The development of the highway network, and its relation to other modes of travel;

   c). Volumes of tourist traffic on recreational highways;

   d). Origins and destinations of tourists.

5. A neglected field of geography is that of the aesthetics of landscape. Necessarily, I had to do some work on this in evaluating the recreational use of land, and the experience has been of help in advising on policy for scenic highways. Further, like all geographers I became imbued with the spirit of the conservationist, a spirit that, luckily, is beginning to possess highway engineers as well.

Because of the special attention I had given to tourism, nowadays most problems involving tourist highways automatically come to me, and I frequently act as the Department's spokesman to the tourist industry, addressing meetings of development associations, tourist outfitters, and chambers of commerce.

Finally, this background has turned out to be of exceptional value in the work of bringing some order into the chaotic complex of Secondary Highways in Northern Ontario. It has helped to devise a policy for such highways, and to apply the policy to individual requests for new Secondary Highways.

The most valuable training that we received was in geographic

research. Both of us had had to submit theses describing what we did, discussing its implications, and drawing the logical conclusions - the exactly appropriate background for the kind of work we would be called upon to do as highway planners. Just last year I took on another young geographer, freshly graduated from McMaster, and he was immediately at home in his new position. Within three months he and an equally young economist were conducting a study that turned out to be of fundamental importance to the Department of Highways, with a minimum of direction.

Thus, though neither Mr. Truemner nor I had any formal preparation for our new work as highway planners, we were not entirely unready to make the contribution expected of us. The catholicity of interests that characterizes the geographer was here of the greatest advantage.

THE HIGHWAY NEEDS STUDY

And we needed every advantage available to us. For each in his turn, immediately upon joining the Planning Division, became involved in the broadest, most comprehensive highway study ever undertaken in Canada, the Highway Needs Study of Ontario.

In an article on "Objectives and Findings of Highway Needs Studies",[9] two senior engineers associated with the chief consulting organization in this field, the Automotive Safety Foundation of Washington, D.C., listed the major elements involved in the conducting of such studies. Among these elements are economics, history, finance, traffic operations, and so on, but geography is nowhere mentioned. Yet among the illustrations are included four very good maps of the land use in the State of Washington. And, indeed, most highway needs studies include a greater or smaller amount of material that may be classed as economic geography. At the same time, however, the treatment this material

receives is almost always superficial.

Factual Background of Highway Needs

To a somewhat lesser degree the same comment applies to the geographic work we did in our own Needs Study. As elsewhere on the continent, the Automotive Safety Foundation was called in as consultant, and on the whole we did what it told us to do, adding such refinements as they were willing to approve. Drawing upon our experience and the many contacts we made, we examined the economic history of the Province, the development of its highway network, the changes that took place in political jurisdictions and modes of finance. We examined the present economy, gathering together all the available material about the whole Province - on the various forms of land use; on the distribution and magnitude of the manufacturing industry; on the population and growth rates of all cities and towns; on the mileage of all King's Highways and the number of vehicles travelling daily on each mile. All this information was concentrated, analyzed and distilled until the pattern of Ontario's economic geography, past and present, emerged, and the likely prospects for the future might be estimated. It was exciting work,for we were dealing with the period of most explosive growth in Ontario's history, and we were attempting to shape one of the chief determinants - may I use the word among geographers? - of this growth: that important part of the circulation system made up by the Provincial Highways.

We took a good deal of trouble with the graphic representation of our findings. Among the resulting maps were those shown in Figs. 1, 2 and 3; the first presents the chief areas in Ontario where various agricultural products are grown, and the second and third, the comprehensive land use patterns in Southern and Northern Ontario respectively.

Functional Classification of Highways

Our next duty was to devise a system for classifying highways so that consistency of service to all urban municipalities and rural areas in the Province might be attained. With the aid of the engineer who was in charge of our work, Mr. P.E. Wade, we devised two new techniques for highway classification,[10] and classified all highways in Ontario accordingly, as Freeways, Major and Minor Trunklines, and Feeders. At the same time we proposed additions to and deletions from the existing Provincial network. A small portion of the resulting classification map is shown in Fig. 4.

It is in this work that we failed to carry our geographic techniques quite as far as we might have done. In attempting to rationalize intercentre highway service, for example, we set up a hierarchy of cities thattook into consideration their populations and nothing more (Figs. 5 and 6). We had available to us such classifications of cities as those devised by Aurousseau, Harris and Nelson; in addition we might easily have devised our own, but we did not. In other phases of our work we had already noticed the differing highway needs of different types of cities: Toronto, as the political, industrial and commercial centre of the Province, with its manifold types of traffic and corresponding variety of roads serving this traffic; Ottawa, where by far the greatest number of licensed commercial vehicles turn out to be furniture-moving vans; the frontier cities of Niagara Falls and Windsor, with the highway-taxation problems peculiar to areas where a large proportion of the motor vehicles originate outside the country; the recreational towns of Wasaga Beach, Grand Bend and Crystal Beach. We did not do the thorough analysis we might have done, and I think that some day we - or someone else - should. This is but one of a great many research problems in the geography of

highways that wait to be attacked.

When attempting to establish a policy for highway service to rural areas, we again took into consideration population alone. We examined the rural population density throughout Southern Ontario, and measured the distances separating highways in all areas, using a concept that we called a "highway cell". We decided (Fig. 7) that for consistency of access to rural highways, all persons living in an area with a given population density should have to travel no more than a given distance on local roads before reaching a Provincial highway; the greater the density, the shorter the distance.

These were the chief contributions of our small group to the Needs Study. Hundreds of other workers, however, were involved - examining the condition of each mile of road, estimating the costs of making the improvements that would give Ontario an adequate highway system twenty years hence, processing the results by means of electronic computers. We helped to design the graphics and edit the written reports on these remaining phases of the study, and the result was published, in 1957, as "A Plan for Ontario Highways". Together with the subsequent report on "Ontario's Roads and Streets", this report has since formed the basis for the quarter-billion annual programme of the Department of Highways.

The reassessment of Ontario's highway needs is a continuing process. As the years pass, the early predictions of future population, vehicle registrations and motor travel will be checked against actuality, and the necessary revisions made. Techniques will be refined, and the increments to geographic knowledge added by academic research workers put to use.

AGRICULTURAL PRODUCTIVITY AND RURAL POPULATION

Out of curiosity, I decided to carry our work on the rural areas of the Province a step further. Was there a statistical relation between agricultural productivity and the density of rural population? And if so, could this relation be used to rationalize highway service to rural areas?

Townships in Southern Ontario

We classified the 357 townships of Southern Ontario under the categories of rural, suburban and tourist (Table 1); we made up our own definition of "agricultural productivity", and, since direct information was not available to us at that time, devised statistical means of estimating it (Table 2); and finally we compared the agricultural productivity of each township with the density of its rural population. The result was startling (Table 3); quite fortuitously, it turned out that, if the agricultural productivity was, say, $35 per acre, the rural population density was likely to be close to 35 persons per square mile. This meant that any classification we made in terms of population would have an equal applicability in terms of the agricultural productivity of an area, and therefore of the rural economy as a whole.

We thereupon plotted the number of townships against value of agricultural productivity, applied a smooth curve to the resulting histogram (Fig. 8), and, from the shape of this curve, classified productivities as Very Low, Low, Average, High, Very High and Intensive (Table 4). After mapping the townships of Southern Ontario according to this classification we ended by

TABLE 1

TOWNSHIPS IN SOUTHERN ONTARIO

RURAL		296
SUBURBAN	48	
TOURIST	6	
SUBURBAN & TOURIST	7	
		61
TOTAL		357

TABLE 2

FORMULAE

FOR COUNTIES

$$GVAP/A = 1.2. + 0.23FV/A$$

$$n = 37$$

$$r = 0.92 \text{ (Signif. at less than 1\%)}$$

FOR RURAL TOWNSHIPS

$$RP/SM = 0.1 + 0.96\ GVAP/A$$

$$n = 296$$

$$r = 0.88 \text{ (Signif. at 1\%).}$$

FOR SUBURBAN TOWNSHIPS

$$P_R = \frac{(16A_T - P_T)\ D_R}{16 - D_R}$$

where $D_R = \frac{RP/SM}{640} = \frac{0.1 + 0.96GVAP/A}{640}$

TABLE 3

RANDOM LIST OF TOWNSHIPS

Showing relation between Agricultural Productivity and Density of Rural Population

COUNTY	TOWNSHIP	AGRICULTURAL PRODUCTIVITY ($/Acre) 1950	RURAL POPULATION (/Square Mile) 1956
Carleton	Fitzroy	25.0	22.6
Elgin	Bayham	49.9	43.2
Essex	Pelee	31.8	32.6
Frontenac	Howe Island	18.8	18.8
Grey	Holland	16.2	17.1
Haldimand	Seneca	26.1	29.6
Halton	Esquesing	44.7	50.7
Hastings	Rawdon	21.8	21.2
Huron	Goderich	27.3	20.3
Lambton	Sombra	25.2	29.6
Lanark	Drummond	16.6	15.3
Wellington	Nicol	40.2	41.0

TABLE 4

AGRICULTURAL PRODUCTIVITY - Value of Production ($/Acre), 1950

&

RURAL POPULATION DENSITY - Persons per square mile, 1956

CLASS	⇩
Very Low	Less than 15
Low	15 - 25
Average	25 - 35
High	35 - 50
Very High	50 - 60
Intensive	Over 60

(Niagara Peninsula 130 - 210)

producing the generalized map of agricultural productivity shown in Fig. 9.

The information we gained about the pattern of agricultural land use in Ontario has turned out to be useful in many ways. For one thing, we were able to prepare a pamphlet for distribution at Fall Fairs and the Canadian National Exhibitions (Fig. 10), which farmers themselves received favourably. For another, the information about individual townships, not only in Southern Ontario but in Northern Ontario as well, has been extremely valuable in helping us to assess the validity of requests from local municipalities for additional road service. As is seen in Fig. 11, we apply the concept of the "highway cell", which we now relate to agricultural productivity as well as to rural population density, to learn how highway service in one small area compares with that of similar areas elsewhere in the Province. Thus we have a factual background to bring to the aid of subjective judgments, and have more confidence in the fairness of our recommendations than we might otherwise have had.

Suburban Populations

We have frequently had the problem of estimating the total urbanized population within a city and its suburban townships. Using the relation we have found between agricultural productivity and rural population density, we have devised a means of extracting the rural population from the total, leaving the suburban population. We have been able to check our results for two cities, Brantford and Cornwall, which have amalgamated with portions of their suburban townships (Fig. 12). In both cases there is a

good correspondence between our estimates of the total urban population in city and township before amalgamation, and the actual population after. The city of London is about to amalgamate with portions of its two suburban towhships. We estimate that the total population will prove to be about 153,000.

REGIONAL STUDIES

The type of study that I as a geographer find most congenial is the regional transportation study, for reasons that are readily evident. We cannot always define our regions in a way that other geographers would find acceptable, so we do not call them by that name. Instead, we call them "areas". For administrative reasons, our boundaries often have to coincide with county boundaries. This was the case with our first ambitious study, which has set the pattern for all that have followed - that on the Hamilton - Wentworth Area, whose boundaries coincide with those of Wentworth County.

Geographic Aspects of Hamilton-Wentworth Study

We began by examining the position of our area in the Province as a whole (Fig. 13), and noting how strategic a location it occupied. Then we focussed our attention on the area itself, first examining its physiography (Fig. 14) and noting the exceptionally difficult transportation problems it presented. Here, in this illustration, is well represented one of our most valuable sources of geographic information and of geographic insights: the great store of knowledge that has been brought together in the theses to be found in the geography departments of universities in

Ontario and elsewhere. This happens to be a particularly fine example, from a thesis by Stuart Westland, but equally good ones have been discovered. We have made good use of theses on the Grand River, on the Niagara Peninsula and the Niagara Escarpment (this area has been exceptionally well studied, with masterly work done on it by Watson, Krueger and Fremlin, among others), on a great number of individual townships, on the Toronto-Hamilton corridor, and on trucking terminals in Toronto.

Another extremely valuable source of information is found in the official plans prepared by local planning bodies. We were fortunate in establishing cordial relations with the planners in the Hamilton-Wentworth area, with the result that their plans and ours have been very closely coordinated. In Fig. 15 we show the land-use pattern of the area, as it is today and as the planners would like to see it twenty years hence. I draw your attention to the southern limit of urban expansion beyond which they would not like to see the metropolitan area extend. This limit was the chief factor that determined our own plans for the location of an east-west expressway across the southern part of the area. We realized that what we did would have radical effects on the surrounding land, and we had to make sure, if it were at all possible, that the location we chose for the new highway would not promote urban sprawl.

Shift in Point of View

Having examined the land use pattern, we next turned our attention to the traffic pattern. Here, for the first time, our

point of view shifted from that of the geographer to that of the engineer. When Edward Ullman, as a transportation geographer, examines the pattern of commodity flow on American railways, (Fig. 16), he is trying to learn something about the areas between which the commodities are exchanged, rather than about the lines along which the exchange takes place. Not so with the engineer. It is the lines themselves that concern him (Fig. 17), and perforce concern us as well. For by relating the traffic demands to the highways that serve them we can decide what improvements are required in the highway system (Fig. 18).

We became, in effect, traffic engineers. Using data provided by engineers throughout the Department, we calculated how many vehicles per hour every mile of highway in Wentworth County could accommodate (Figs. 19 & 20); we predicted the volume of traffic each mile would be expected to carry twenty years hence, and how soon it would be overloaded; we examined the costs of making the needed improvements, and balanced these costs against benefits to the motorists and to the community - in money and time saved, in increased convenience and safety, in the retardation of urban sprawl and the promotion of healthy civic development. Finally, we set up a programme of highway improvement in the Hamilton-Wentworth area, staging these improvements in five-years periods: this must be done now, this in five to ten years, and so on, for the full twenty years of our planning period. It would be enough to widen the pavements of certain roads by a few feet; others would have to be widened to four lanes; still others would be entirely obsolete, and would have to be replaced by entirely new

controlled-access highways of four, six or eight lanes (Fig. 21).

No doubt it would be desirable to be able to retain one's geographic point of view in all one's work, but in a highway planner any attempt to do so would be much too limiting. And, after all, where is the geographer who can at all times be nothing but a ageographer, much as that "nothing but" embraces?

A more serious limitation is that, in an operational, engineering organization, the opportunity for doing fundamental research, geographic or otherwise, is lacking. I feel this lack keenly, and for this as for other reasons I hope one day to be enabled to return to the university for a time.

NEED FOR RESEARCH AND TRAINING

If we do no research ourselves, at least we try to learn something of what is being done by others. As I have said, the literature in highway planning is vast, and we try to take time away from our routine work to take advantage of its existence. In recent months a whole group of us has done almost nothing but a study the ways of applying the gravity model to the problems of finding the relation between urban land use and motor trip generation in Ontario cities. To this important technique we are also trying to graft the methods of the new school of regional science, such as the space potential concept of Warntz and Stewart. This means that some of us will have to gain a certain competence in operations research and linear programming. Others are studying ways of refining our statistical methods; until now we have been relying heavily on regression analysis, but the field

of statistics has much more to offer than that, and in our work a thorough grasp of sampling procedures for example, becomes more and more necessary.

The organization chart of our Section (Fig. 22) gives some idea of the scope of our work, and of the opportunities there are in it for geographers. There are other places in the Department where well-trained geographers could find a place - in soils research or highway location, for example - but it is here, in our Section, that the greatest opportunities lie.

My own position is that of Head of the Transportation Studies Group. Though specialists in other disciplines could undoubtedly fill it, this is now considered preeminently a geographer's position. Many of the other positions in this group might well be filled by geographers, if they were available, as might some in the Urban Studies Group. All in all, no fewer than ten, and probably a good many more, geographers could be profitably used by the Department. Multiply this by the sixty state and provincial highway departments in the United States and Canada, and add the federal agencies, private consulting firms, and transportation industries, and you see how vast are the opportunities for geographers in this field.

When Trevor Lloyd addressed you a year or two ago he mentioned the almost ideal climate for geographers in Canada today. "In many parts of Europe and most notably in the Soviet Union", he added, "it is now unthinkable that a large-scale project of the magnitude of the St. Lawrence Seaway ... (and other

projects) ... would be thought possible without the active participation of geographers at all levels. The newness and youth of the geographical profession here is of course one reason for the modest contribution made so far, but it is not a good reason for future inactivity. May I urge my professional colleagues not to be hesitant in offering their services on even the largest schemes. There is no inherent opposition to the employment of geographers in such work, but there is widespread unawareness of what they are capable of doing."[11])

These words were recently echoed by the engineer who is my immediate superior, in even stronger terms. Geographers must make themselves known, he insisted; they must force their way into highway departments everywhere. It was one of his proudest claims, he added, that he was the first to insist on having geographers join the Department of Highways in Ontario.

The way is open. Let us have your bright young students. But please, please, give them some training in transportation geography, and in doing so, I beg you, let them know that there is such a thing as a highway.

.....

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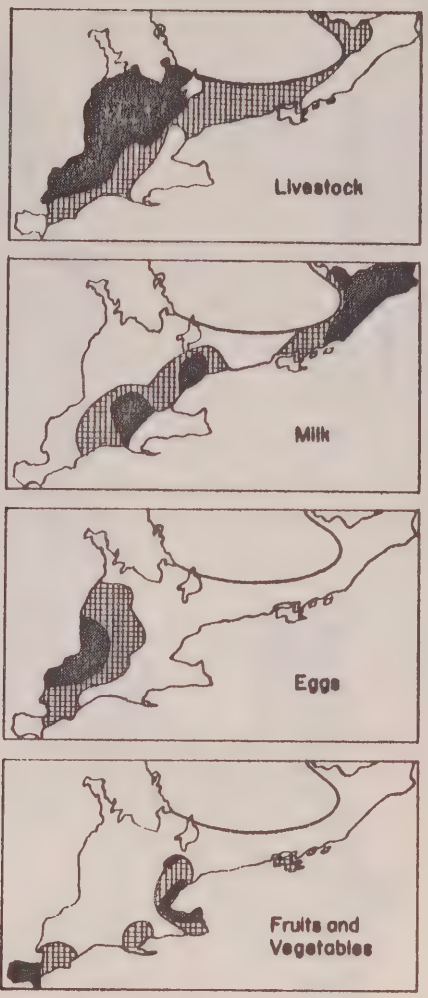
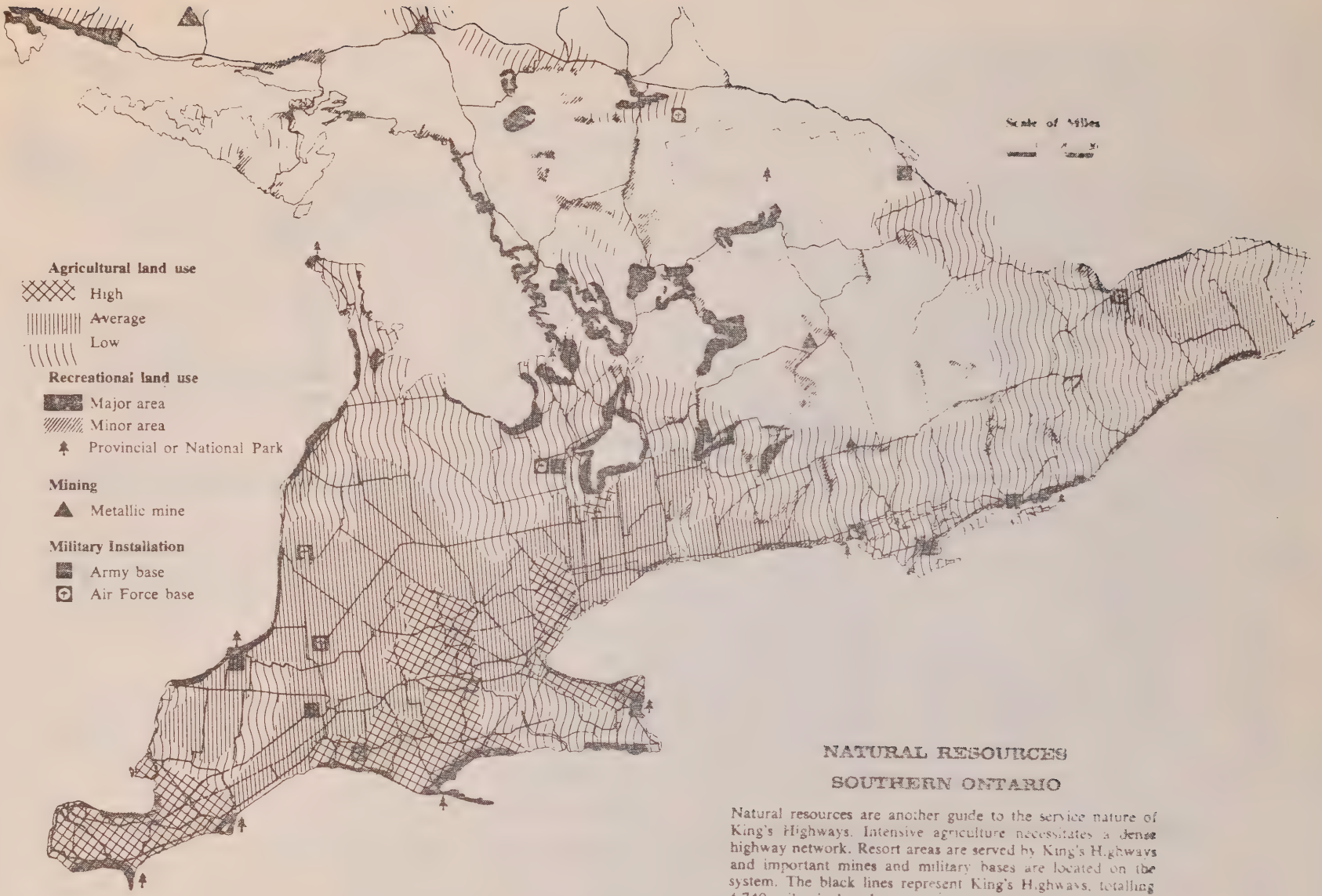
The distribution of the growing areas of agricultural products that are transported mainly by truck illustrates the wide-spread need for highway service. The solid color represents areas of greatest productivity.



From "A Plan for Ontario Highways," published by the Department of Highways, Ontario, Toronto 1957.

Figure 1.



NATURAL RESOURCES
SOUTHERN ONTARIO

Natural resources are another guide to the service nature of King's Highways. Intensive agriculture necessitates a dense highway network. Resort areas are served by King's Highways and important mines and military bases are located on the system. The black lines represent King's Highways, totalling 4,740 miles in length.

Figure 2.

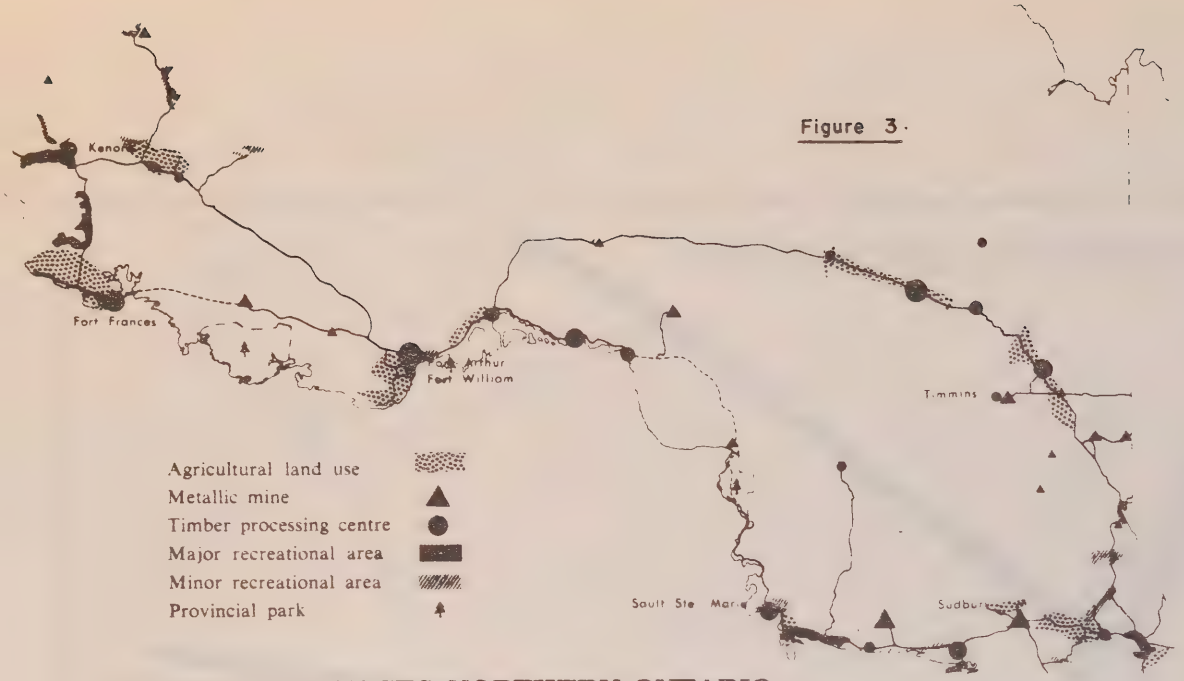


Figure 3

NATURAL RESOURCES–NORTHERN ONTARIO

Natural resources, and the communities associated with them are paramount in the evaluation of King's Highway service in Northern Ontario. Agriculture is not significant in these areas, whereas mining, forestry, and recreational developments are of major importance.

taking into account the different type of service required in the two areas. The selected System and classes are shown in the map on page 29.

MAJOR TRUNKLINE HIGHWAYS

It was recognized that a Major Trunkline Highway was required as an interprovincial route across Northern Ontario. The route selected passes through Sault Ste. Marie and closely parallels the north shore of Lake Superior to the Lakehead. That highway will provide service between the five major cities of Northern Ontario—Fort William, Port Arthur, Sault Ste. Marie, Sudbury, and North Bay; it will provide access to important mining developments; it will provide a shorter route to the west through Ontario from eastern Canada; and it will link up major U.S. highways. From Sudbury westward, it is the route of the Trans-Canada Highway.

The Major Trunkline class connects interprovincial and international routes, serves major population centres, and provides access to important mining, forest and tourist areas.

TRUNKLINE HIGHWAYS

Other important cities and towns in Northern Ontario, as well as major centres of mining, pulp and paper production, and tourist attraction are served by Trunkline Highways. All places with a population of 2,000, or greater, are on a Trunkline Highway.

The great future growth expected of new mining developments at Elliot Lake, Manitouwadge, and Atikokan was considered. Trunkline Highways, some to be constructed at a future date, were recommended for service to those centres.

FEEDER HIGHWAYS

Those remaining highways that served smaller communities, moderate traffic volumes and minor developments were designated as Feeder Highways. All places of over 500 people are located on at least a Feeder route, and many smaller places are also served. Each area was provided access consistent with its population density, as determined in a manner similar to that for Southern Ontario.

CLASS CHARACTERISTICS

The tables below show the distinction between classes of King's Highways in Northern Ontario. Comparison of these tables with those on page 29 will quickly show the difference between Northern and Southern Ontario.

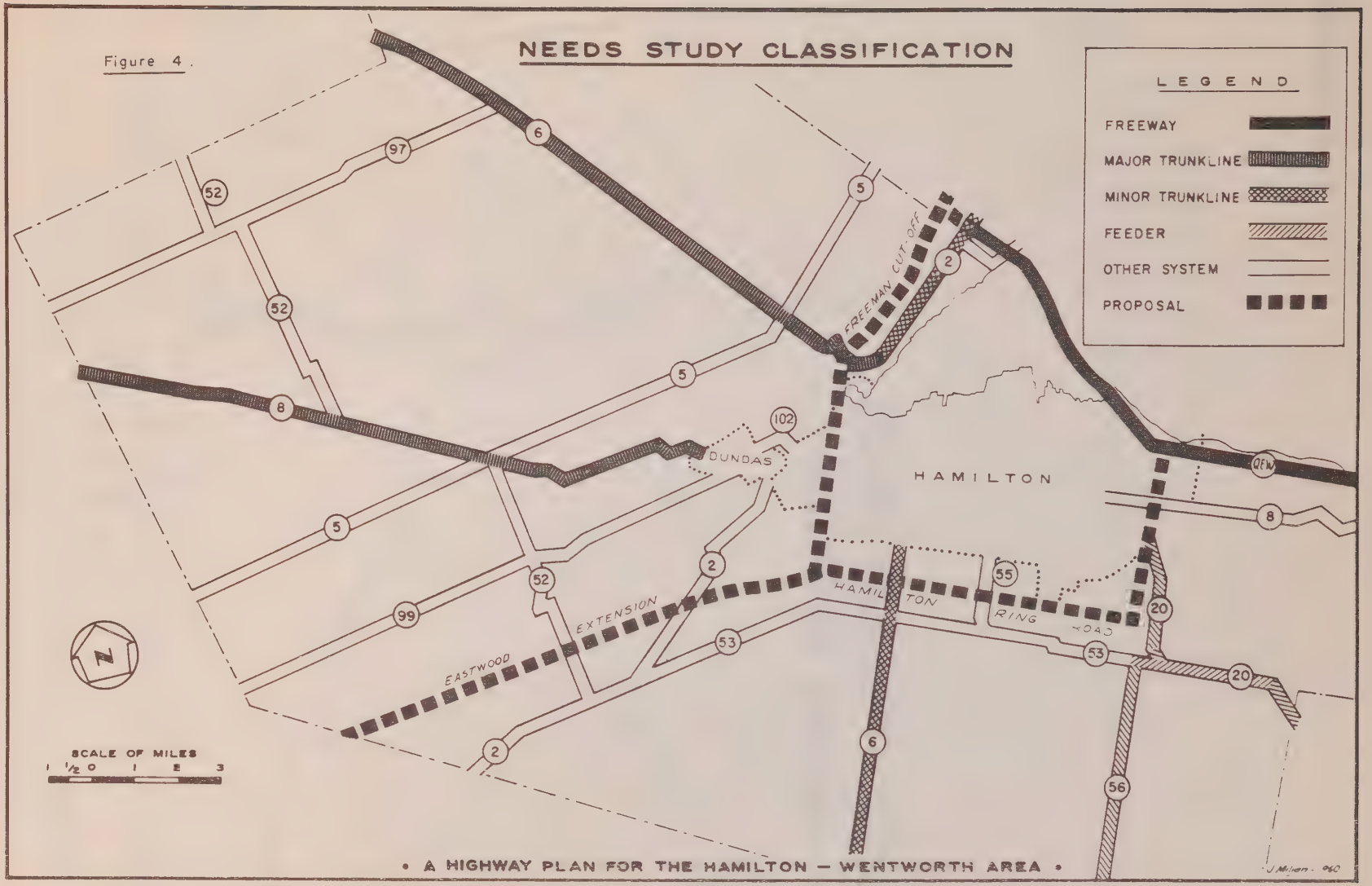
CLASS CHARACTERISTICS
NORTHERN ONTARIO

Class	INTERCENTRE SERVICE *(Point Rating)*	AVERAGE TRAFFIC *(Vehicles per day)*
Trunkline	3.2	700
Major	(4.5)	(800)
Other	(1.7)	(600)
Feeder	—	450
		(Average) 600

SUMMARY OF CLASSIFICATION
NORTHERN ONTARIO

Class	MILES *Number*	MILES *Percent*	TRAVEL *Percent*
Trunkline	2,800	73	80
Feeder	1,060	27	20
Total	*3,860*	*100*	*100*

Figure 4.


NEEDS STUDY CLASSIFICATION
LEGEND
FREEWAY
MAJOR TRUNKLINE
MINOR TRUNKLINE
FEEDER
OTHER SYSTEM
PROPOSAL
FREEMAN CUT OFF
DUNDAS
HAMILTON
QEW
EASTWOOD
EXTENSION
HAMILTON
RING ROAD
SCALE OF MILES
1 ½ 0 1 2 3
N
• A HIGHWAY PLAN FOR THE HAMILTON — WENTWORTH AREA •

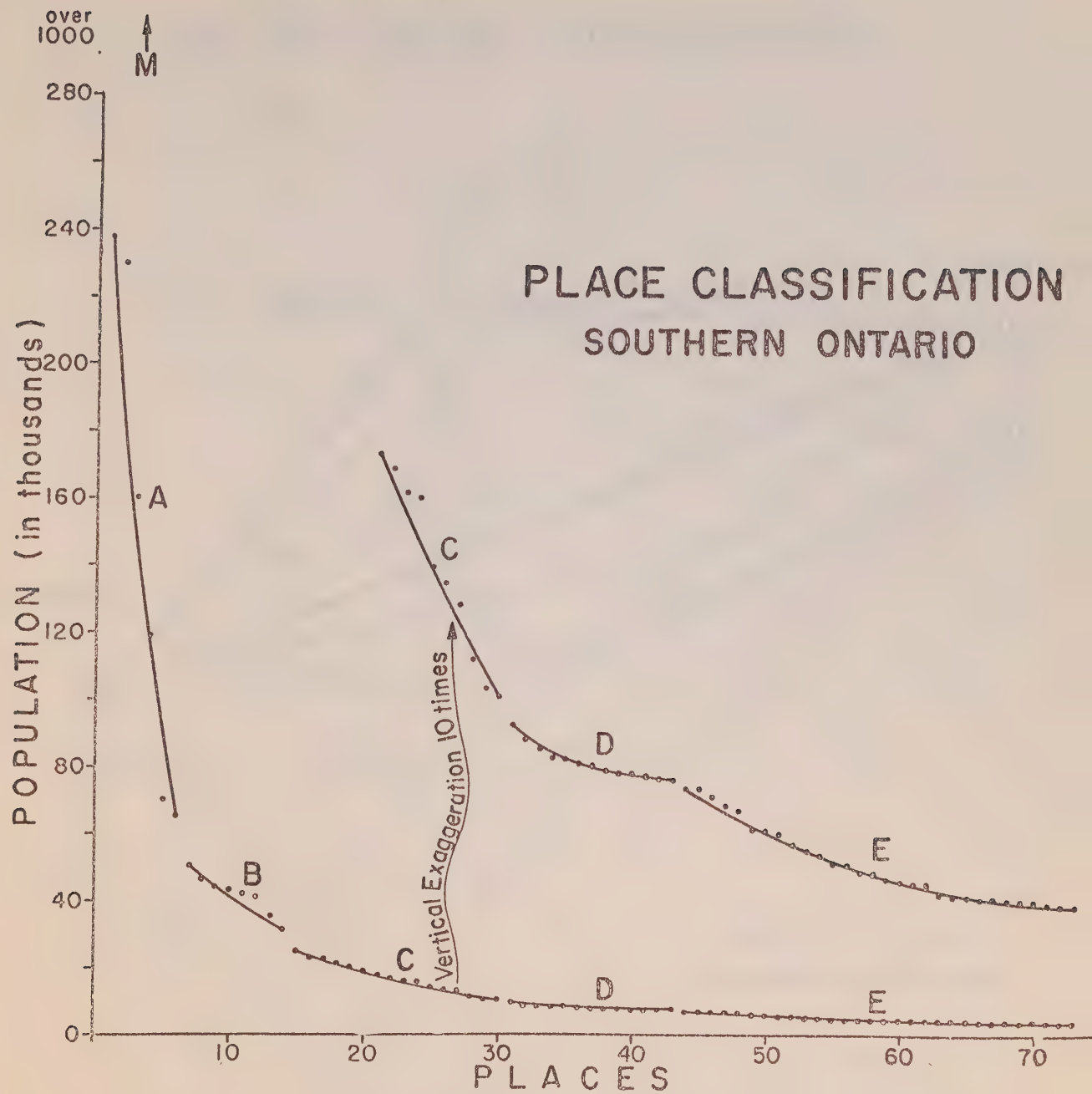

PLACE CLASSIFICATION
SOUTHERN ONTARIO
POPULATION (in thousands)
over 1000
M
280
240
200
160
120
80
40
0
A
B
C
C
D
D
E
E
Vertical Exaggeration 10 times
10
20
30
40
50
60
70
PLACES

Figure 5.

INTERCENTRE CONNECTORS

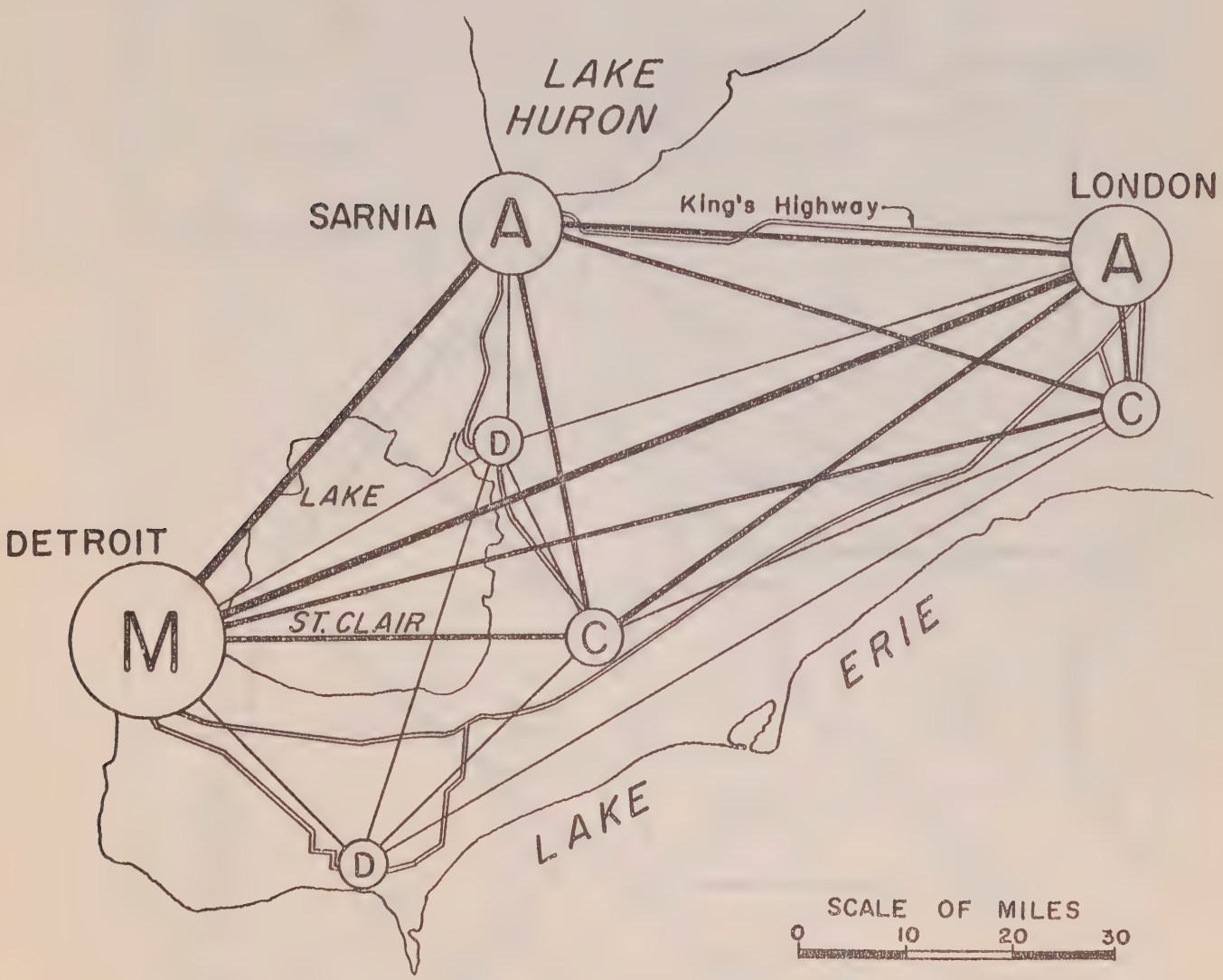


Figure 6.

RURAL ACCESS SERVICE

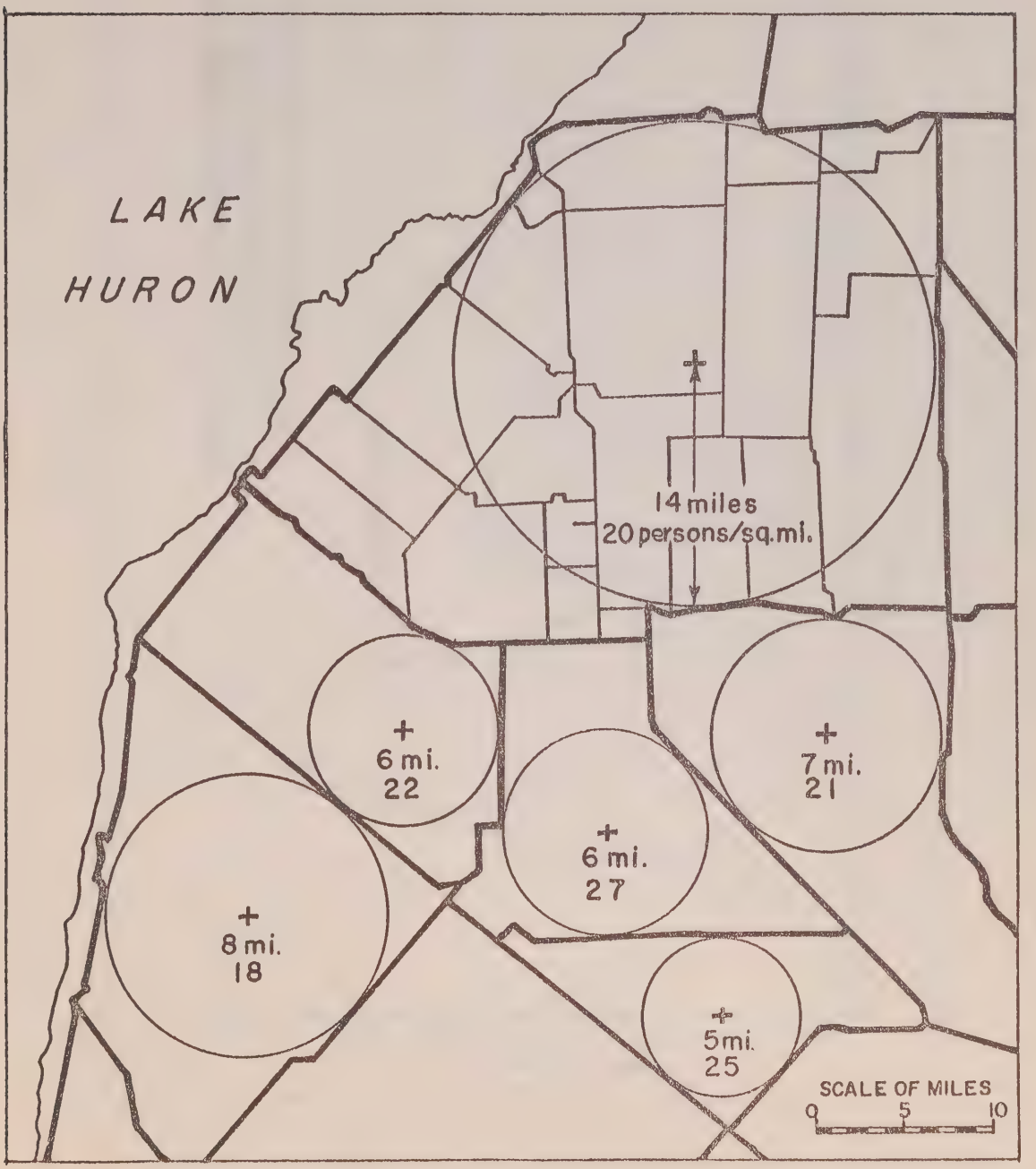


Figure 7.

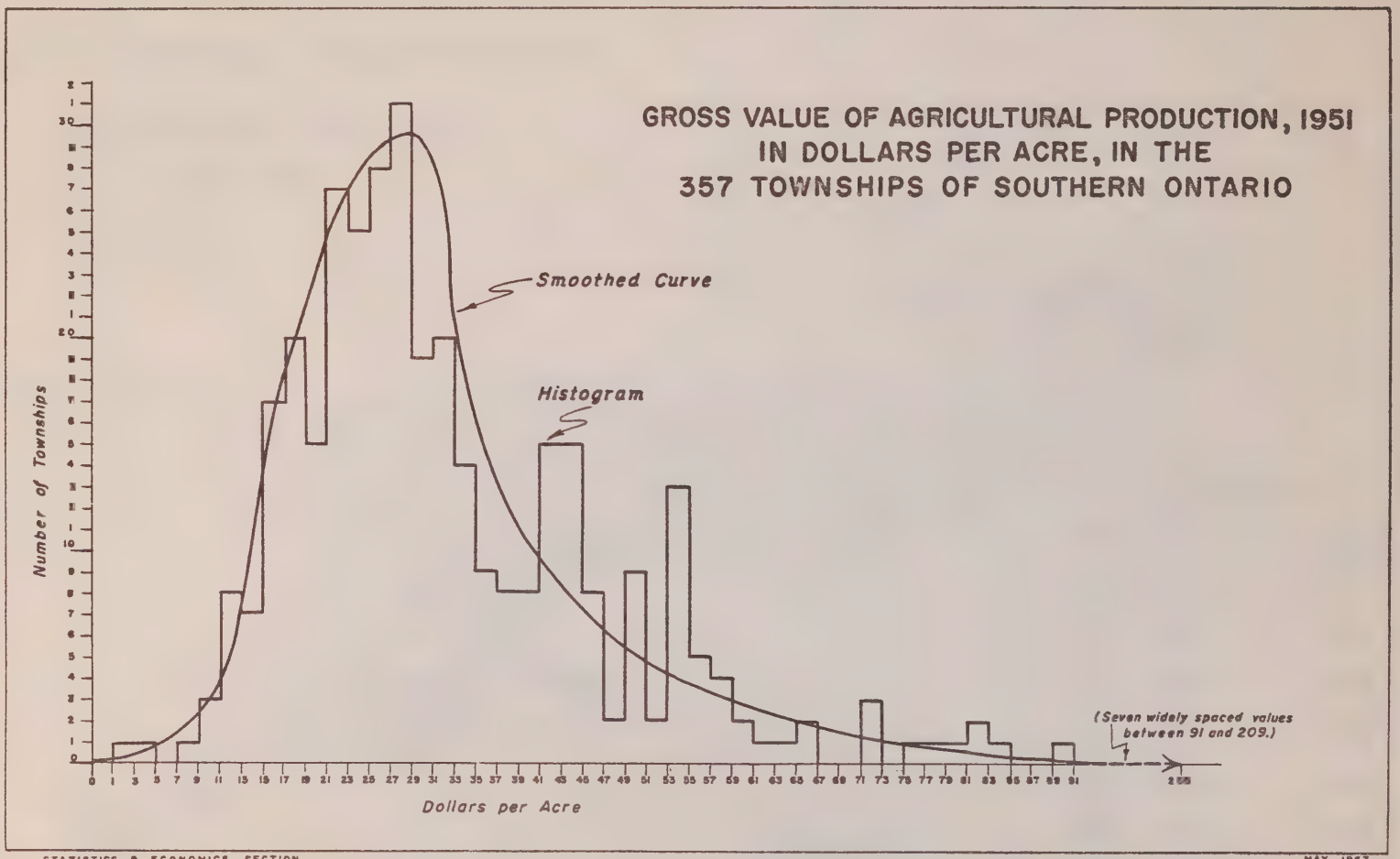

GROSS VALUE OF AGRICULTURAL PRODUCTION, 1951
IN DOLLARS PER ACRE, IN THE
357 TOWNSHIPS OF SOUTHERN ONTARIO
Smoothed Curve
Histogram
Number of Townships
Dollars per Acre
(Seven widely spaced values between 91 and 209.)
STATISTICS & ECONOMICS SECTION.
MAY, 1957.

Figure 8.

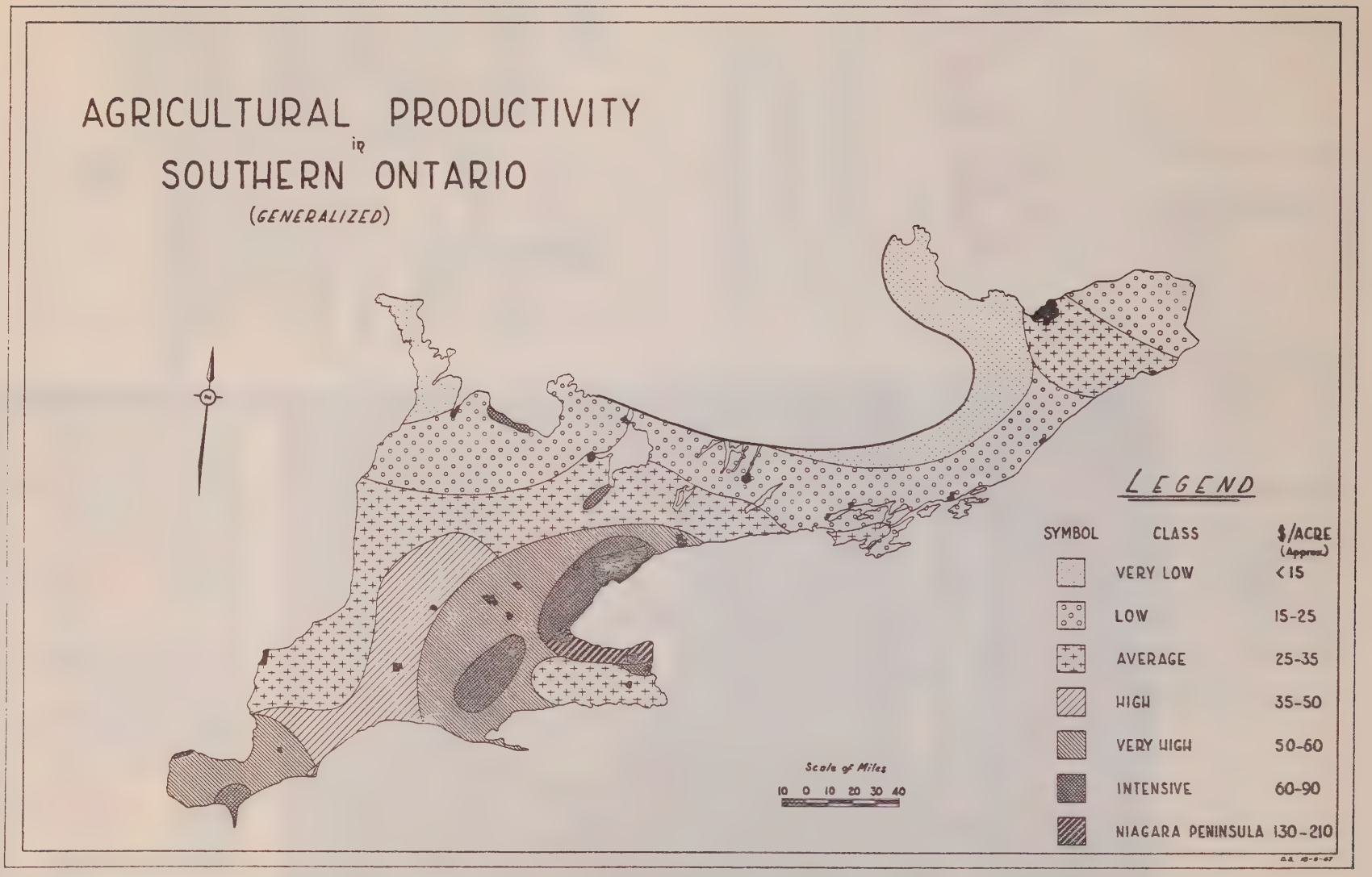

AGRICULTURAL PRODUCTIVITY
IN
SOUTHERN ONTARIO
(GENERALIZED)
LEGEND
SYMBOL
CLASS
$/ACRE (Approx.)
VERY LOW
< 15
LOW
15-25
AVERAGE
25-35
HIGH
35-50
VERY HIGH
50-60
INTENSIVE
60-90
NIAGARA PENINSULA
130-210
Scale of Miles
10 0 10 20 30 40

Figure 9.

If the farmers of Ontario are served by a good system of roads – as they are – they have themselves to thank for it.

Sixty-five years ago farmers were responsible for starting the Ontario Good Roads Association. Because of O.G.R.A. Ontario got its first Highway Improvement Act in 1901, when there were only 200 cars in all Ontario. All along, it was the farmer that saw the need for rural roads, and went after the Government to provide them. And to a very large extent, he still does.

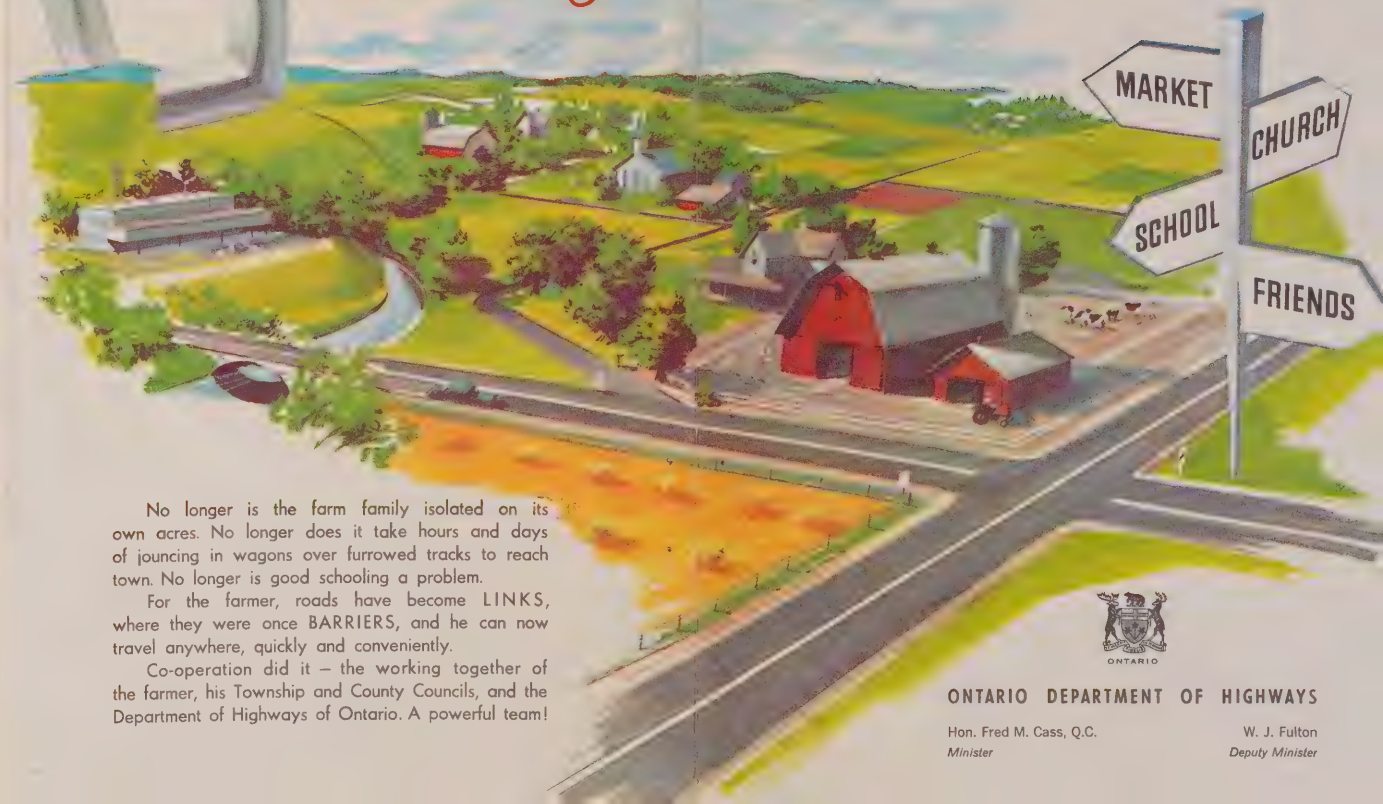
Provincial assistance for County and Township roads and bridges has been steadily increasing over the years.

THE DEPARTMENT OF HIGHWAYS TAKES SERIOUSLY ITS RESPONSIBILITY TO MAKE THE MOST APPROPRIATE TYPE OF ROAD AVAILABLE TO ALL PARTS OF ONTARIO AND TO ALL ITS PEOPLE.

Roads

FOR THE FARMING COMMUNITY

Good Roads
THE LINK
that means Better Living



No longer is the farm family isolated on its own acres. No longer does it take hours and days of jouncing in wagons over furrowed tracks to reach town. No longer is good schooling a problem.

For the farmer, roads have become LINKS, where they were once BARRIERS, and he can now travel anywhere, quickly and conveniently.

Co-operation did it – the working together of the farmer, his Township and County Councils, and the Department of Highways of Ontario. A powerful team!

ONTARIO

ONTARIO DEPARTMENT OF HIGHWAYS

Hon. Fred M. Cass, Q.C.
Minister

W. J. Fulton
Deputy Minister

BETTER ROADS WINTER & SUMMER MEAN BETTER EDUCATION FOR EVERYONE

In Ontario To-day:

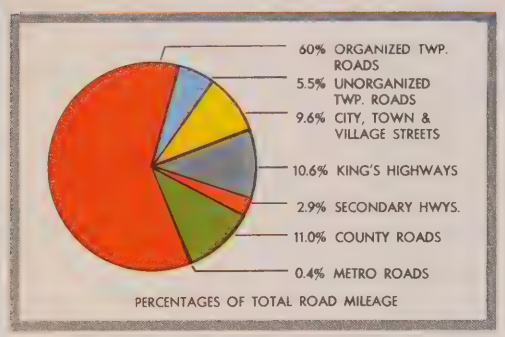
- School buses travel on over 4,800 different rural routes, in all kinds of weather, to carry more than 126,000 pupils to large, well equipped Elementary and Secondary Schools.
- In the past 15 years, over 440 Central Elementary Schools have been built, thus enabling more than 1,000 of the old one-room schools to be closed.
- The new schools have brought many beneficial results, and in some areas have become centres of community activity.

They have:

- ▲ Attracted better teachers. Brought better education, and longer schooling to farm children.
- ▲ Helped improve health programmes.
- ▲ Led to better libraries, and adult education programmes.

ALL MADE POSSIBLE BY BETTER ROADS

Ontario's Farm Products



PERCENTAGES OF TOTAL ROAD MILEAGE

Forty-odd years ago, the total cost of Ontario's 55,000 miles of UNPAVED roads was less than $10,000,000.00. To-day, through the Department of Highways, the Province spends over one quarter billion dollars annually on its 85,000 mile network of highways, roads and streets.

The dirt roads of the past have become the paved highways of to-day. Nearly 11,500 miles of King's Highways and Secondary Roads serve as main arteries.

At least three out of every four miles of the different types of highways and roads in the Province are of direct concern to the Farmer because of his reliance on trucking in marketing his produce. Farming and marketing have changed as well as highways.

Although Ontario has one of the best and ever-improving road networks in the world, there is still much to be done. Over 7,000 miles of County roads have improved or gravel surfaces that are becoming increasingly important. 1,600 of the 55,000 miles of Township roads have been paved, and another 2,700 will be paved in future. Further development and improvement will guarantee the equitable distribution of highway service to Farmers in every part of the Province.

WORTH OVER A BILLION DOLLARS EACH YEAR MOVED LARGELY BY ROAD

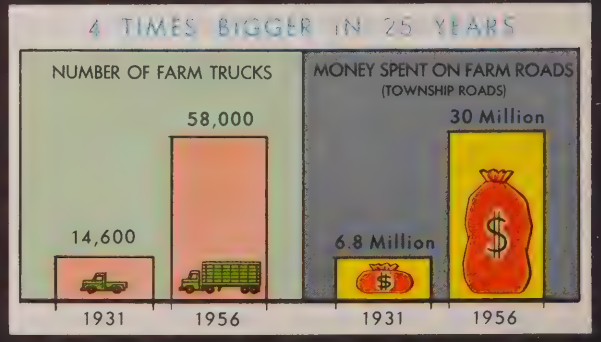
9% ?

91% OF LIVESTOCK SHIPPED BY TRUCKS
77% OF FRUITS & VEGETABLES
100% OF ALL MILK

THE PERISHABLE PRODUCTS OF THE FARM REACH THEIR MARKET SAFELY, FAST AND STILL FRESH OVER ONTARIO'S GOOD ROADS.

ONE BILLION DOLLARS PLUS!

That is the value of farm products grown by Ontario farmers every year. Most of the produce has to be shipped – and the bulk of it is carried over Ontario's good roads.



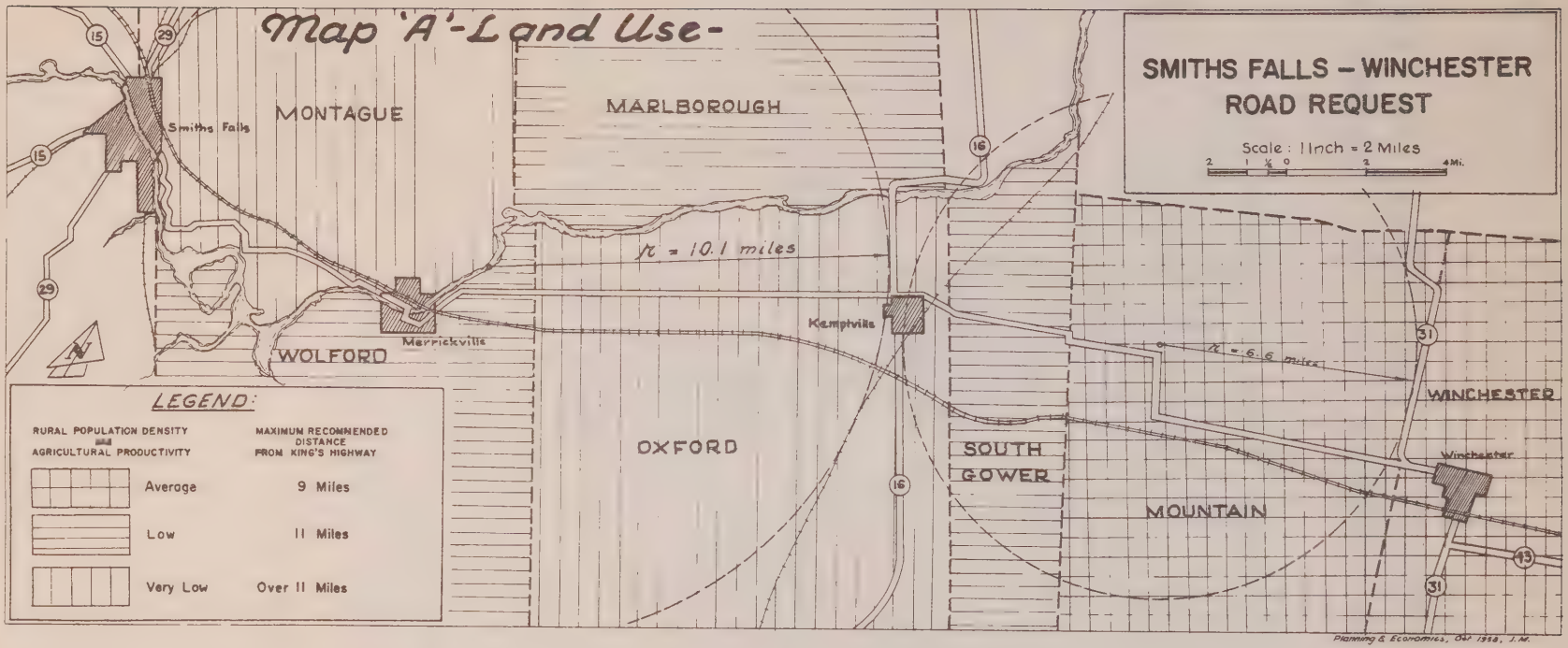

Map 'A'-Land Use-
SMITHS FALLS – WINCHESTER
ROAD REQUEST
Scale: 1 Inch = 2 Miles
2 1 ½ 0 2 4 Mi.
MONTAGUE
MARLBOROUGH
Smiths Falls
WOLFORD
Merrickville
Kemptville
OXFORD
SOUTH GOWER
MOUNTAIN
WINCHESTER
Winchester
= 10.1 miles
= 6.6 miles
LEGEND:
RURAL POPULATION DENSITY
AGRICULTURAL PRODUCTIVITY
MAXIMUM RECOMMENDED DISTANCE FROM KING'S HIGHWAY
Average 9 Miles
Low 11 Miles
Very Low Over 11 Miles
Planning & Economics, Oct 1958, I.M.

Figure 11.

ESTIMATES OF SUBURBAN POPULATIONS IN BRANTFORD AND CORNWALL

	Before Annexation	After Annexation
BRANTFORD	(1954)	(1956)
City	36,526	
Suburban	12,694*	
City & Suburban	49,220	50,618
Rural	5,968*	6,639
Total	55,188	57,257
CORNWALL	(1955)	(1956)
City	17,160	
Suburban	23,122*	
City & Suburban	40,282	39,155
Rural	2,273*	2,919
Total	42,555	42,074

* *Calculated on assumption that density of suburban population in township was 16 persons per acre, giving formula*

$$P_R = \frac{(16 A_T - P_T) D_R}{16 - D_R} \; ; \quad P_S = P_T - P_R$$

Figure 12.

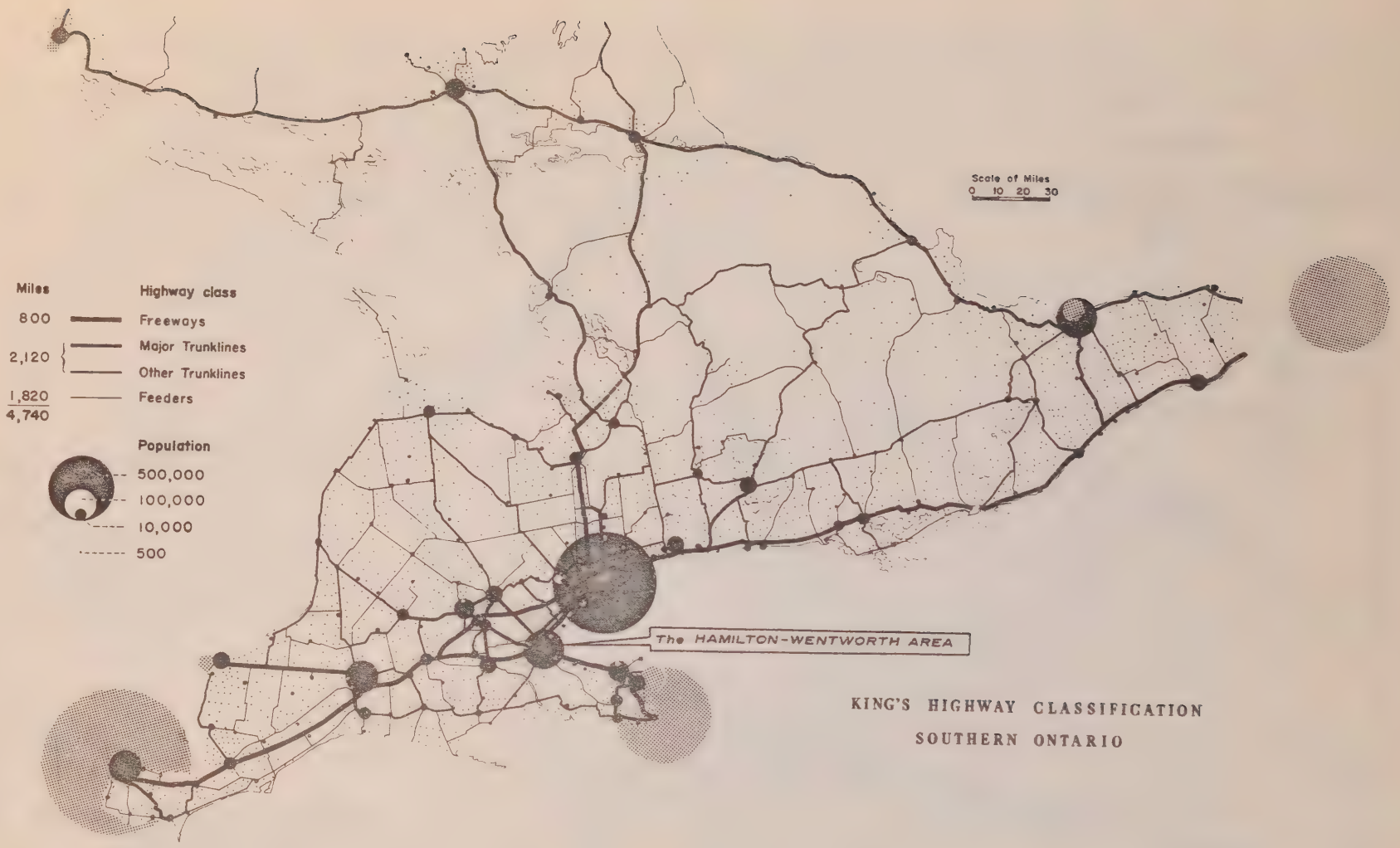

Miles
Highway class
800
Freeways
2,120
Major Trunklines
Other Trunklines
1,820
Feeders
4,740
Population
500,000
100,000
10,000
500
Scale of Miles
0 10 20 30
The HAMILTON-WENTWORTH AREA
KING'S HIGHWAY CLASSIFICATION
SOUTHERN ONTARIO

Figure 13.

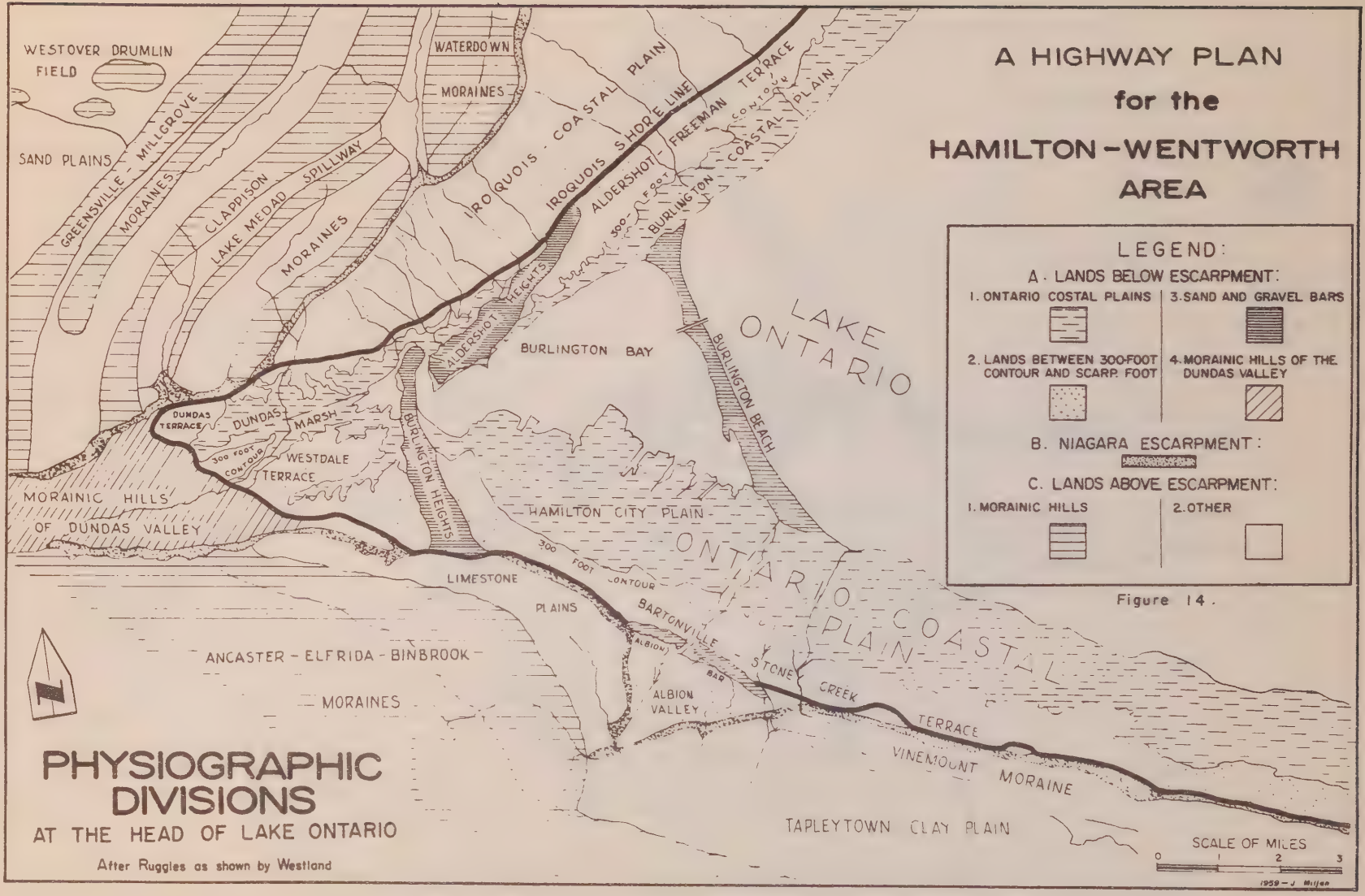


Figure 14.

PHYSIOGRAPHIC DIVISIONS

AT THE HEAD OF LAKE ONTARIO

After Ruggles as shown by Westland

• A HIGHWAY PLAN FOR THE HAMILTON – WENTWORTH AREA •

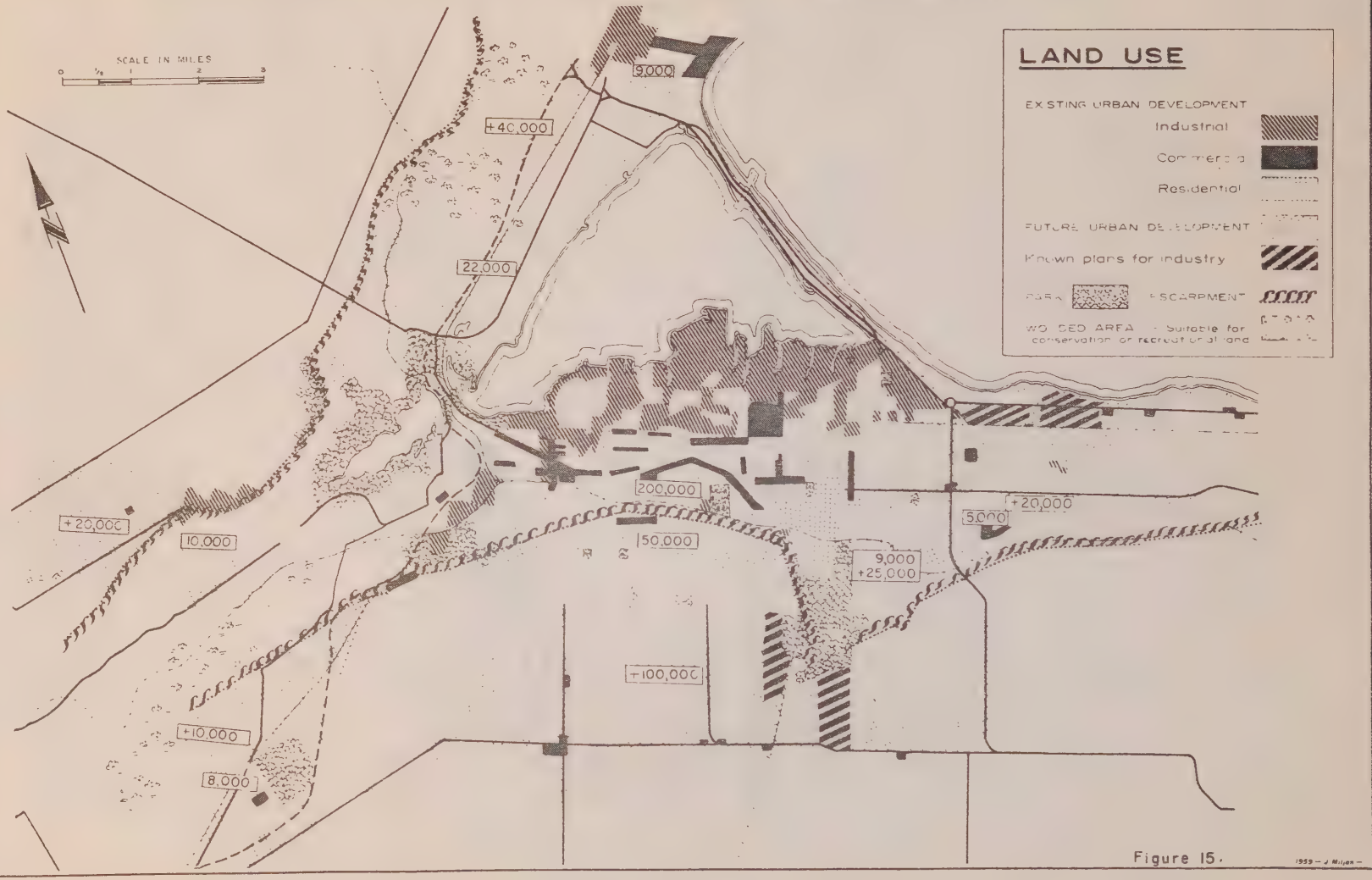


Figure 15.

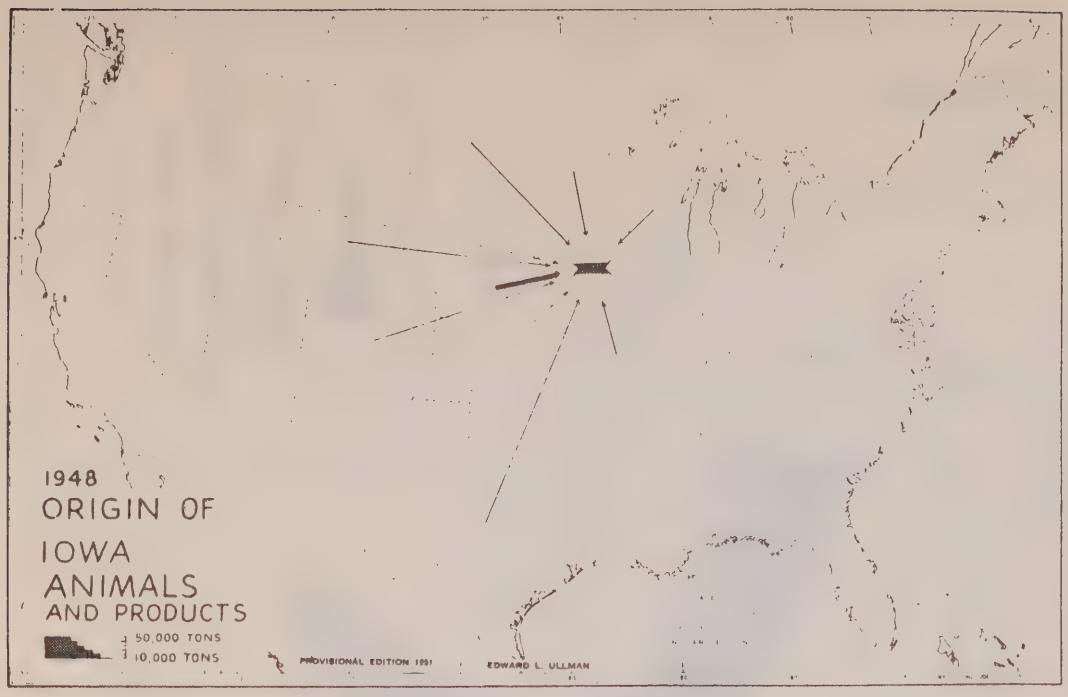


FIG. 164.—Origin, by states, of animals and products shipped by rail into Iowa, 1948. Width of lines is proportionate to volume on Figs. 164 and 165. (Tons are short tons of 2,000 pounds.)

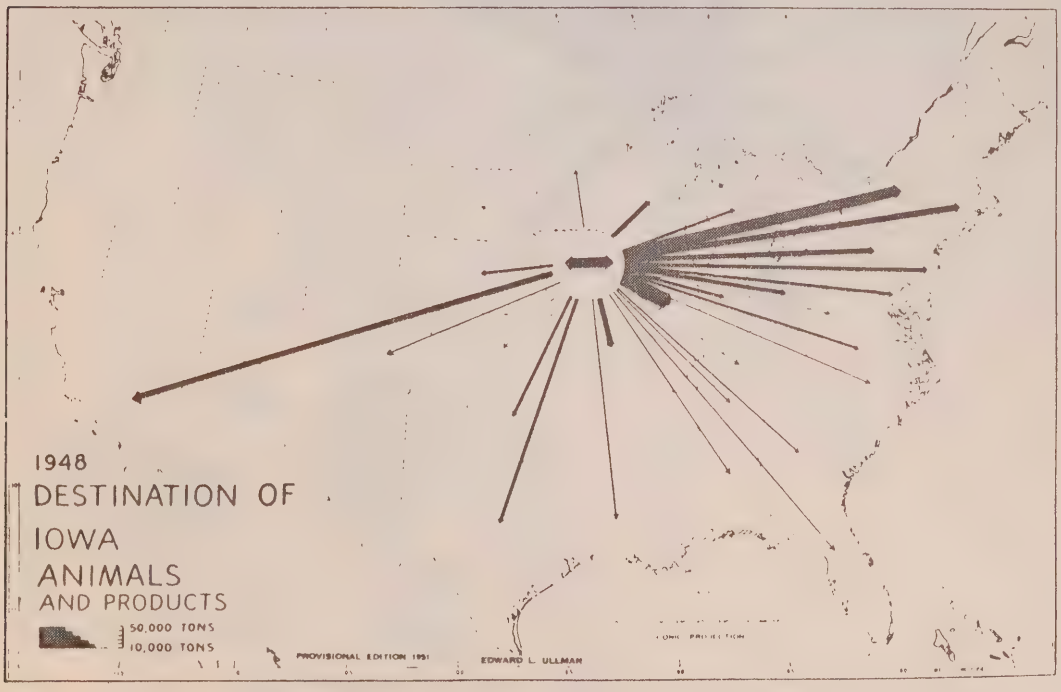


FIG. 165.—Destination, by states, of animals and products shipped by rail from Iowa, 1948. Source of data for Figs. 162 and 165 is Interstate Commerce Commission's 1 per cent sample of rail traffic reported in *Carload Waybill Analyses* (Washington, D.C., 1948) (statements: 4838, October, 1948; 492, January, 1949; 498, March, 1949; 4920, June, 1949). (Tons are short tons of 2,000 pounds.)

by Edward L. Ullman.

Figure 16.

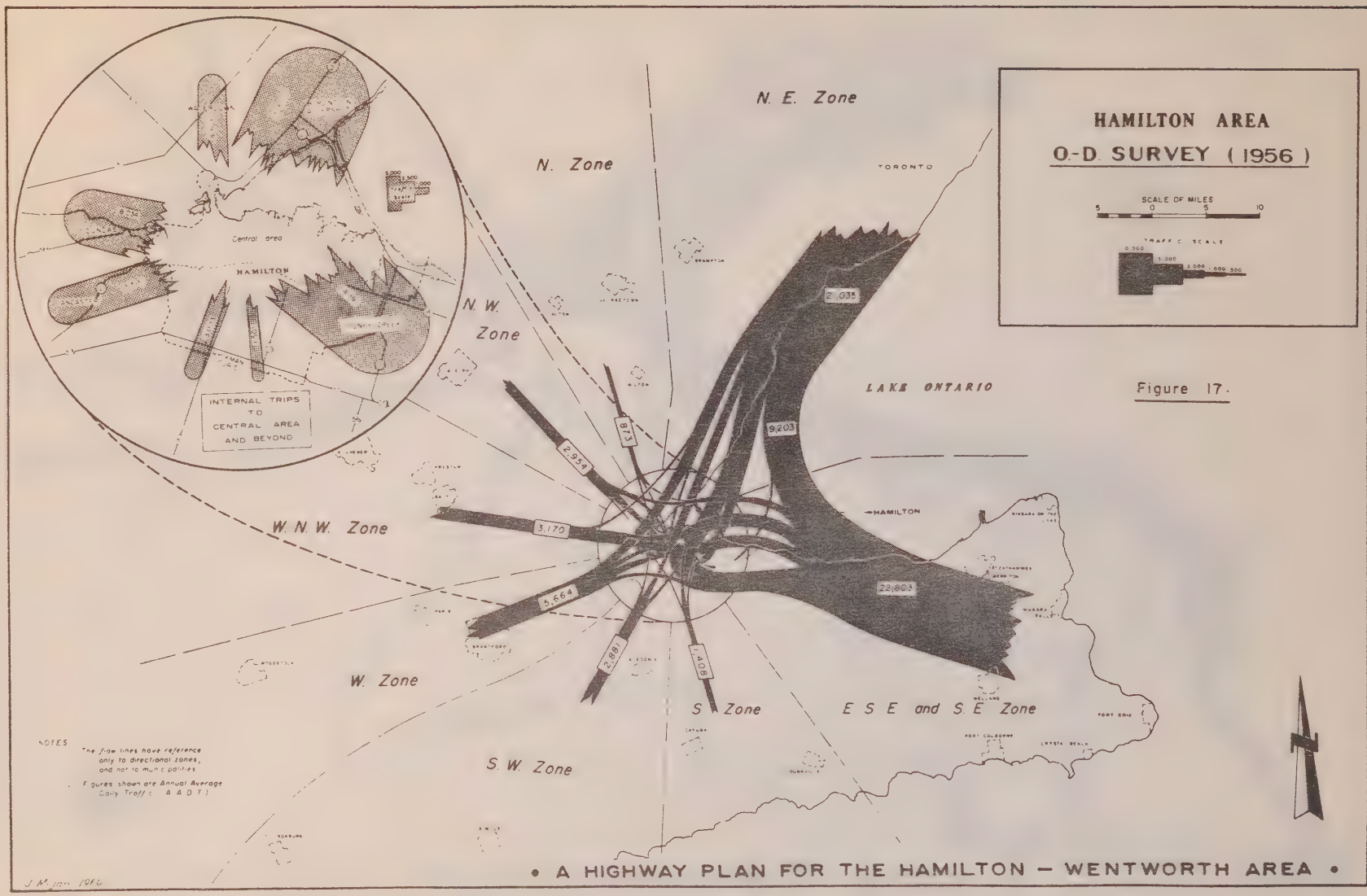
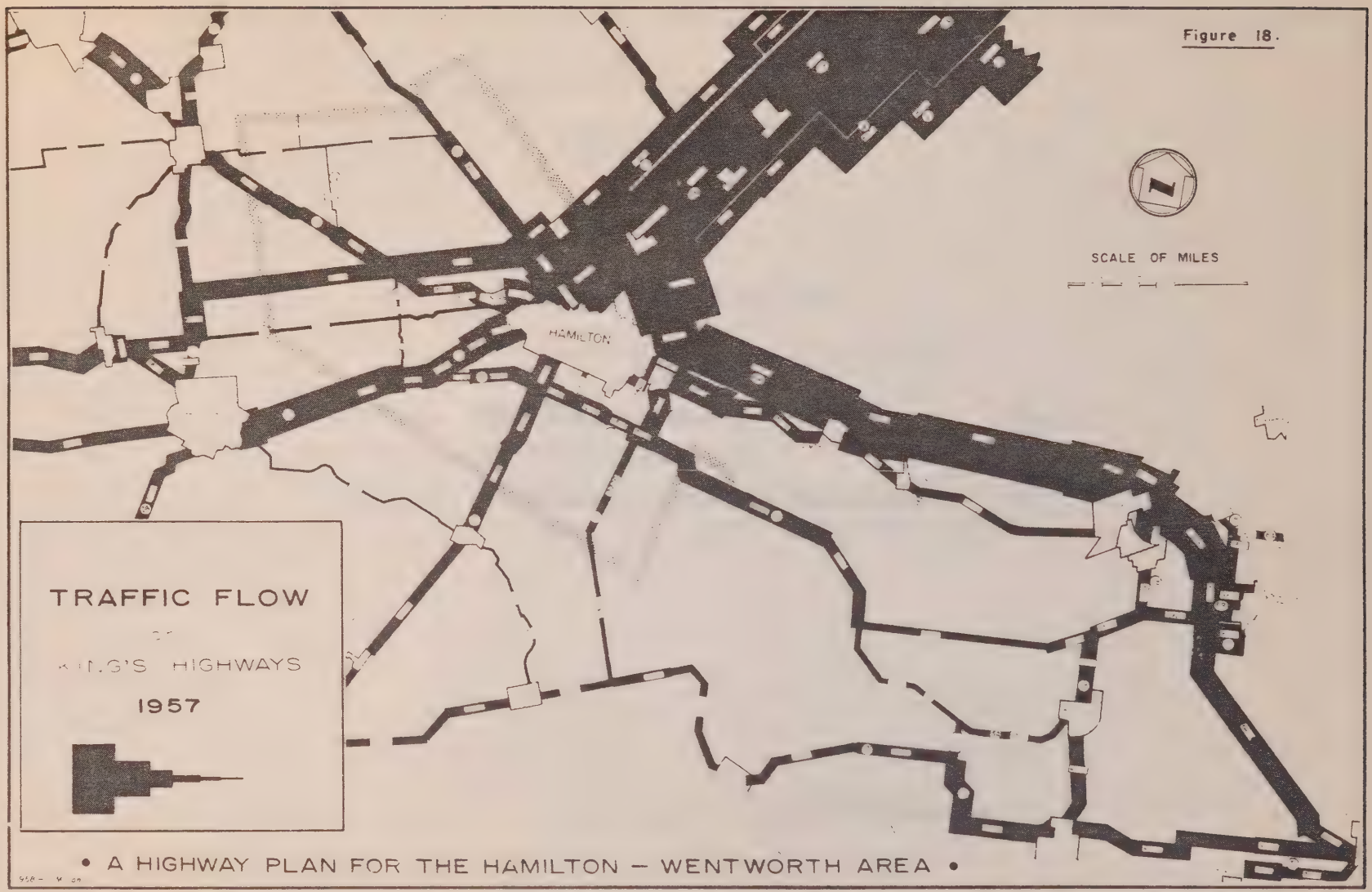


Figure 17.

• A HIGHWAY PLAN FOR THE HAMILTON — WENTWORTH AREA •

Figure 18.



• A HIGHWAY PLAN FOR THE HAMILTON – WENTWORTH AREA •

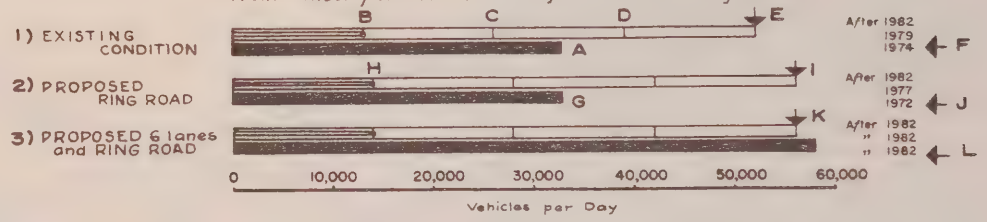
— CAPACITY / VOLUME CHART. —

EXAMPLE

QUEEN ELIZABETH WAY.

Section No. 1. - Rating Section No. Q.E.W. 4-6-8 (6.8 miles).

From Lincoln/Wentworth County Line to Jct. Hwy No. 20.



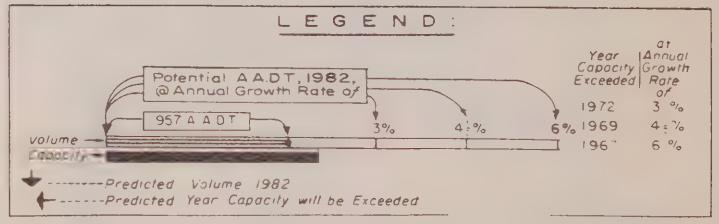


Figure 19.

• A HIGHWAY PLAN FOR THE HAMILTON – WENTWORTH AREA •

VOLUME – CAPACITY RELATIONS IN 1982

IF PROPOSED NEW CONSTRUCTION COMPLETED

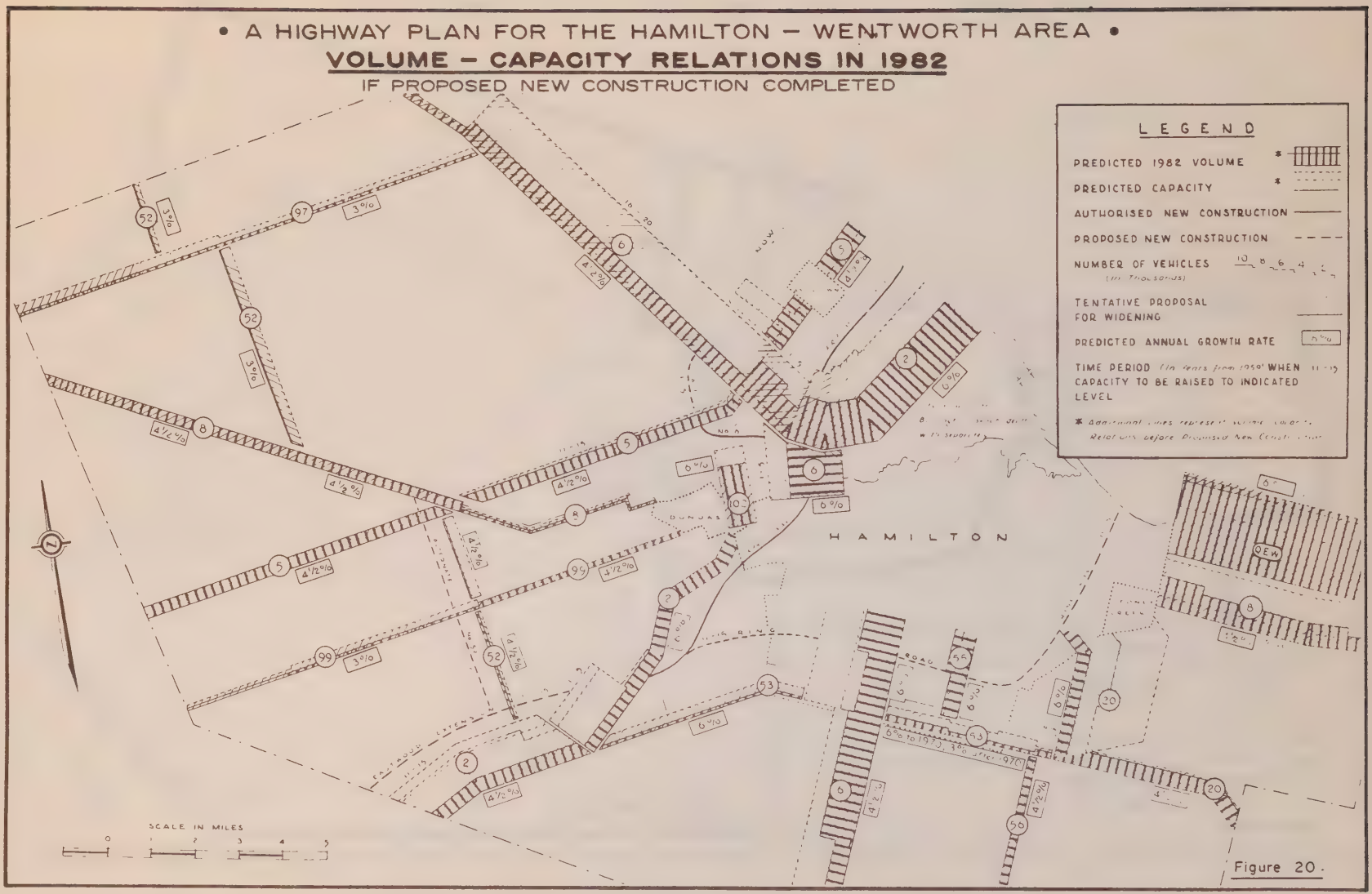
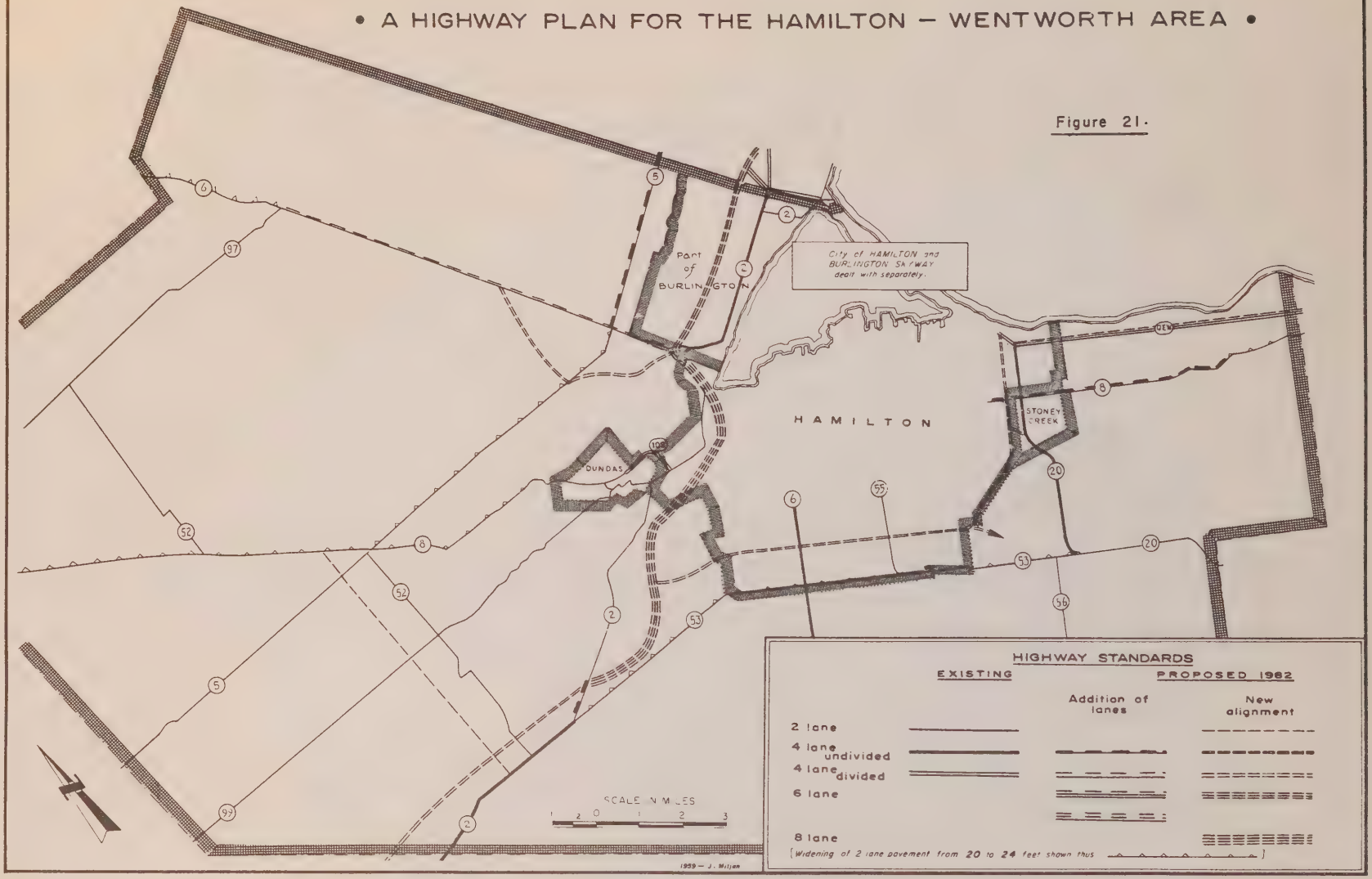


Figure 20.

• A HIGHWAY PLAN FOR THE HAMILTON – WENTWORTH AREA •

Figure 21.



STATISTICS & ECONOMICS

ORGANIZATION CHART

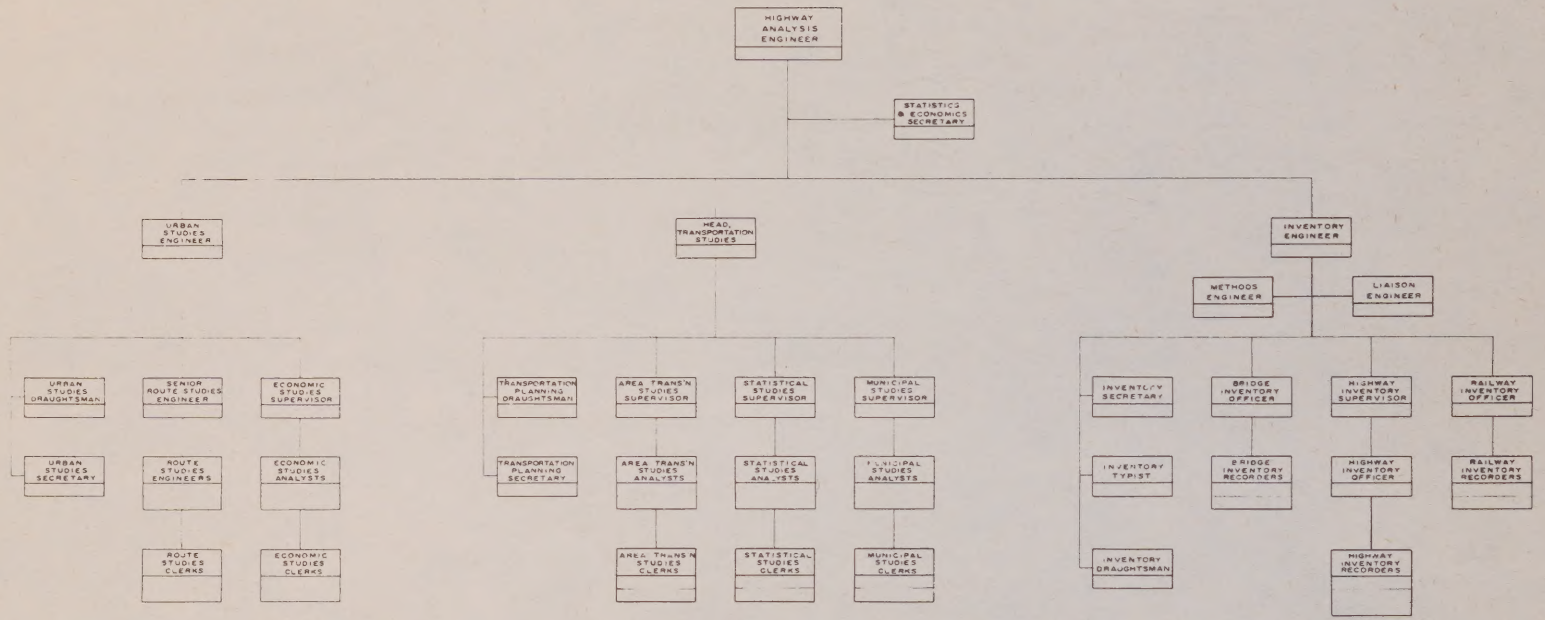


Figure 22.